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FACTORY

MANAGEMENT and MAINTENANCE

A McGRAW-HILL PUBLICATION

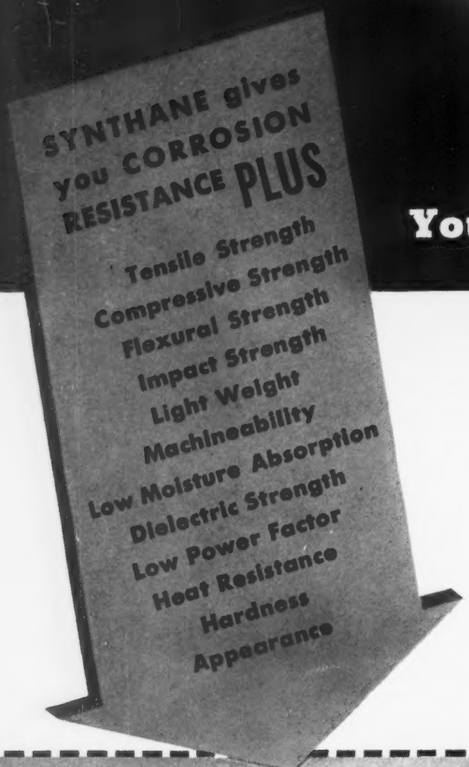
OCT - 7 1939

THE INDUSTRIAL TOWN OF TOMORROW (PART TWO)

HOW TO RATE JOBS AND MEN (GREEN-PAPER SECTION)

143.862

You can FIGHT CORROSION with SYNTHANE



. . . as electroplating equipment manufacturers have done

YOU, and every reader of "Factory" with a corrosion problem, can profit by the successful application of Synthane Bakelite-laminated to electroplating and electrolytic process equipment.

The structural members of electrolytic extraction equipment, perforated plating cylinders (see above), piping for plating solutions, structural members for electrolytic processing equipment, and sheathing for current-carrying bars are often made of Synthane . . . for several *combined* reasons. Synthane resists corrosive electrolytic solutions. It is mechanically strong, low in moisture absorption, nonmetallic, an excellent electrical insulator, and easy to machine. It withstands the knocks of tumbling parts.

Successful applications have also been made in equipment handling rayon and cellophane process solutions, mine waters and oils. Synthane has, in fact, proved unusually effective in combating many acids, alkalies, salts, oxidizing agents, gases, solvents, and other corrosive liquids and gases.

If you have a corrosion condition to overcome in your plant, or in parts or equipment you make for others . . . we may be able to help you . . . in 3 ways: 1) with the facilities of our laboratory, 2) through the use of Synthane sheets, rods and tubes, 3) by machining parts from Synthane with our specialized tools.

MAIL THIS COUPON TODAY

SYNTHANE CORPORATION, OAKS, PA.

Please send me further information about Synthane Bakelite-laminated for _____

Ask your representative to get in touch with me.

Name _____

Position _____

Company _____

Address _____

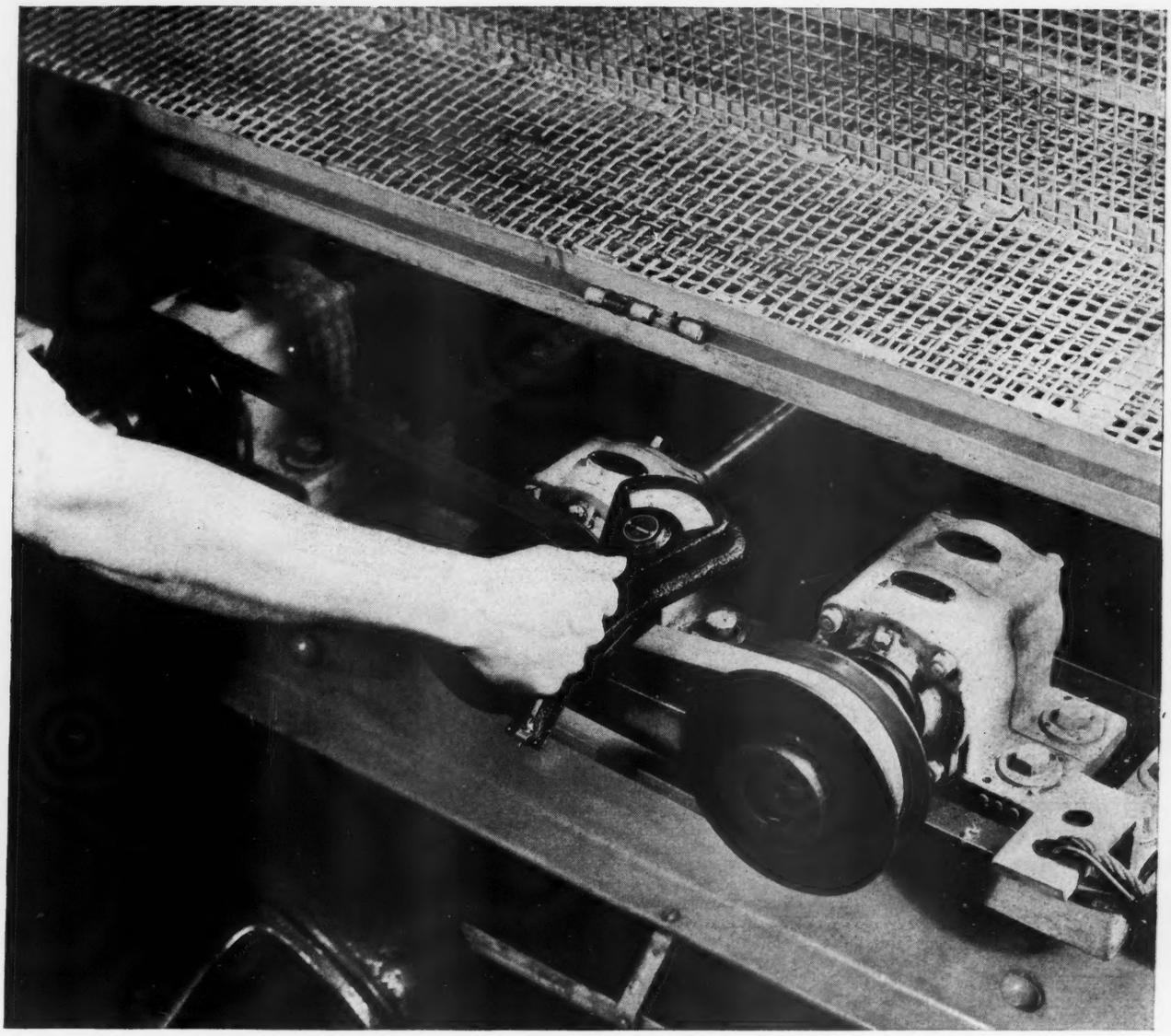
SYNTHANE

Bakelite- *laminated*

SHEETS • RODS • TUBES • FABRICATED PARTS • SILENT STABILIZED GEAR MATERIAL

SYNTHANE CORPORATION, OAKS, PENNSYLVANIA

To Put off MAINTENANCE TROUBLES . . *Put In* SYNTHANE



His thermometer says fever has passed, the patient will live—longer

A typical example of Goodrich improvement in rubber

HE'S "taking the temperature" of a V-Belt — the rubber-and-fabric belt that drives thousands of America's machines. But when a short belt like this whirls around its pulleys, terrific heat is generated. Internal heat destroys belts, and V-belts were breaking down, causing stoppage of machinery, costing too much to maintain.

Goodrich engineers went to work on this "belt fever." They made up new compound after compound of rubber, made each into a belt, ran it until it wore out, taking its temperature as carefully as though it were a hospital fever patient in a crisis.

Finally a compound was discovered that did carry off the heat as developed, and so did run cooler. After scores more experiments this was perfected — it operates 75% cooler than old rubber compounds. At once this new development was used in all Goodrich V-Belts — and immediately belt costs went down in thousands of plants, production shut-downs were reduced, new records for belt life began to be made.

This sort of research goes on constantly at Goodrich—125 engineers are engaged exclusively in making every Goodrich product better, longer lived, less expensive for you to use. To be certain you are getting all the benefits of this great program of improvement, you have only to specify *Goodrich* to your Distributor. The B. F. Goodrich Company, Mechanical Rubber Goods Division, Akron, Ohio.

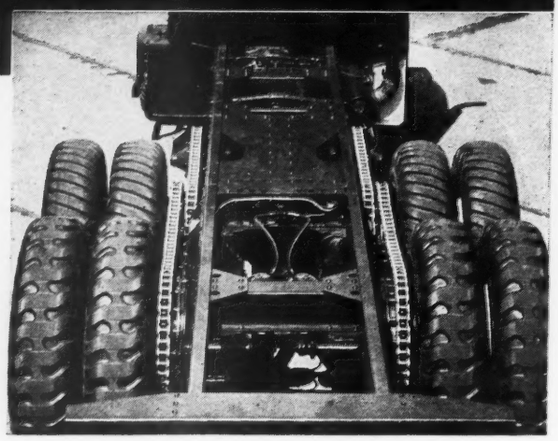
Goodrich

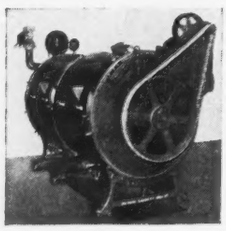
ALL *products problems* IN RUBBER

What Design Engineers are doing with Silverlink Roller Chain!

Giant 30-Ton Trucks Driven by SILVERLINK ROLLER CHAIN

Two of these giant Mack trucks were built for strip mine haulage. Each has a body capacity of 40 cu. yds., and will hold 30 tons of coal. They are 6-wheelers, with the 4 dual-tired driving wheels in the rear being driven with Silverlink roller chain. Silverlink has set the pace for dependable long life peformance in severe service of this kind.



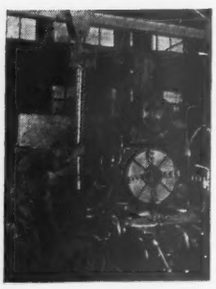


Hospital Laundry Machine Quiet, Dependable

The Henrici washing machine employs a Link-Belt Silverstreak silent chain drive on the first reduction from the motor, and a triple-width Link-Belt Silverlink roller chain from the first reduction to the sprocket wheel on the washing machine cylinder. The Henrici organization states that hospital engineers and mechanics are enthusiastic about the silent, smooth operation of these chain drives, that they give smoother acceleration, that they have simplified the matter of lubrication, made adjustments easier, and have practically eliminated repair expense.

Light Weight Electric Hoist Uses Silverlink

The "Budgit" Hoist, which is a product of the Shaw-Box Crane and Hoist Division of Manning, Maxwell and Moore, Inc., weighs only 58 pounds and has a 500-lb. lifting capacity at a speed of 17 ft. per minute and operates from light socket, with no additional wiring required. To obtain the performance that this new hoist gives, with a unit so light in weight, Silverlink roller chain, instead of the usual link lifting chain, is employed.



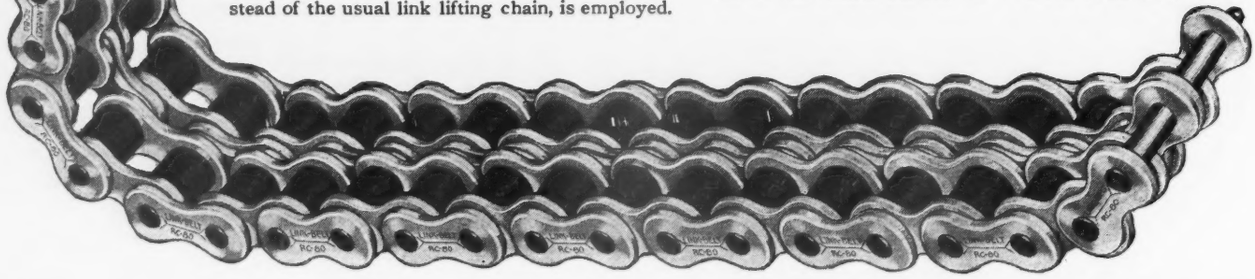
● Design and plant engineers alike recognize the value of Silverlink's accurately finished, all-steel construction, built to the highest standards of precision . . . that it combines great strength with comparatively light weight . . . that it is extremely flexible, assures smooth operation, and is especially capable of withstanding severe shocks . . . that it minimizes wear and repair. They recognize, too, the value of Link-Belt engineering service in working out problems in connection with the use of roller chains for conveying and power transmitting. Send for Engineering Data Book No. 1757. It is a hand book of roller chain practice and design.

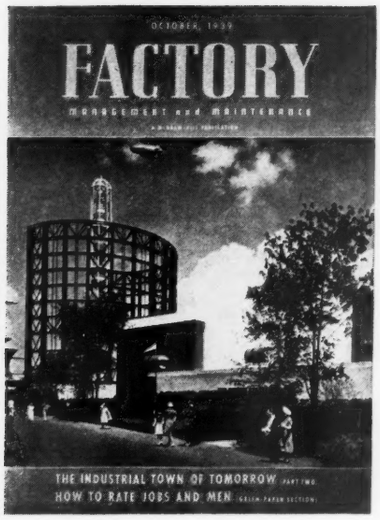
LINK-BELT COMPANY 7828

Indianapolis Chicago Philadelphia Atlanta
San Francisco Toronto
Branch Offices and Distributors in Principal Cities

New York World's Fair Exhibitor—Metals Building

LINK-BELT *Silverlink* ROLLER CHAIN





Why not an appropriate symbol on tomorrow's plant? The idea has attractive possibilities as carried out by du Pont—not in a factory building, to be sure, but in its exhibit at the New York World's Fair. Half inclosed in a 70-ft. shell of steel tracery, the 107-ft. "Tower of Research" makes an impressive entrance to the du Pont "Wonder World of Chemistry." It is a giant representation of a distillation unit, an indispensable tool of chemical research, and is 35 times larger than the apparatus from which it was modeled. Kodachrome by a McGraw-Hill staff photographer. Blimp by courtesy of the U. S. Navy.

●

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FACTORY

MANAGEMENT and MAINTENANCE

OCTOBER, 1939

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5 YEARS ON SUICIDE ROW!

Another true case history from the Allis-Chalmers files that proves **"IT PAYS TO BUY THE EQUIPMENT THAT PAYS FOR ITSELF!"**

Read the Record-Breaking Performance Story of an Allis-Chalmers Lo-Maintenance Motor! Find Out How It Beat Conditions that "Cracked-Up" Ordinary Motors in 60 to 90 Days! Get the Facts on Full-Measure Protection in Lo-Maintenance Motors.. On the Savings It Means to You!

NOT A PRETTY PICTURE! But this Lo-Maintenance Motor was running perfectly five years after it was installed in this chemical plant! The full measure protection built into every Allis-Chalmers motor beat operating conditions that wrecked other motors in 60 to 90 days!

When operating conditions are tough . . . when motors "crack-up" in 60 to 90 days . . . that's a challenge to every manufacturer who makes motors! And when an Allis-Chalmers Lo-Maintenance Motor stands up for five years under those same conditions. . . without running up costs . . . without breaking down . . . that's a story you'll want to know!

This all happened in the factory of a big chemical company . . . and in the part of their plant where chlorine is used in processing products, they had motor trouble . . . plenty of it! For chlorine fumes seeped into the motors . . . ate off winding insulation . . . wrecked them nearly as fast as they were installed! No wonder they called it "suicide row"!

Then they installed the Allis-Chalmers Lo-Maintenance Motor that broke every record!

Chlorine gas . . . moisture . . . heat couldn't stop it! And at the end of five years' time that Lo-Maintenance Motor was running as perfectly as the day it was installed!

Why was an Allis-Chalmers Lo-Maintenance Motor able to beat adverse operating conditions? Why was it able to stand up 20 times longer than ordinary motors? The answer is the Full-Measure Protection built into every Allis-Chalmers Lo-Maintenance Motor!

Learn What Allis-Chalmers Can Do For You!

When you buy a Lo-Maintenance Motor you get more than a motor that delivers just a rated horsepower. You get a motor that has built into it the results of Allis-Chalmers' 90 years of advancing with industry . . . of making motors to meet the rigid requirements of their own famous line of heavy duty industrial equipment.

High carbon steel frame . . . indestructible rotor and stator . . . husky all-around construction with no skimping on materials . . . add them together and you get a motor that's built for long life . . . without running up costly repair bills!

Get the Full-Measure story of Lo-Maintenance Motors. Call the nearest Allis-Chalmers District Office or write direct to Allis-Chalmers. Find out how you can cut maintenance . . . keep production steady . . . with Allis-Chalmers Lo-Maintenance Motors!

1005

MOTORS FOR ALL APPLICATIONS FROM ½ HORSEPOWER AND UP

ELECTRICAL DIVISION

ALLIS-CHALMERS

MILWAUKEE · WISCONSIN

5 BRIEF CASES

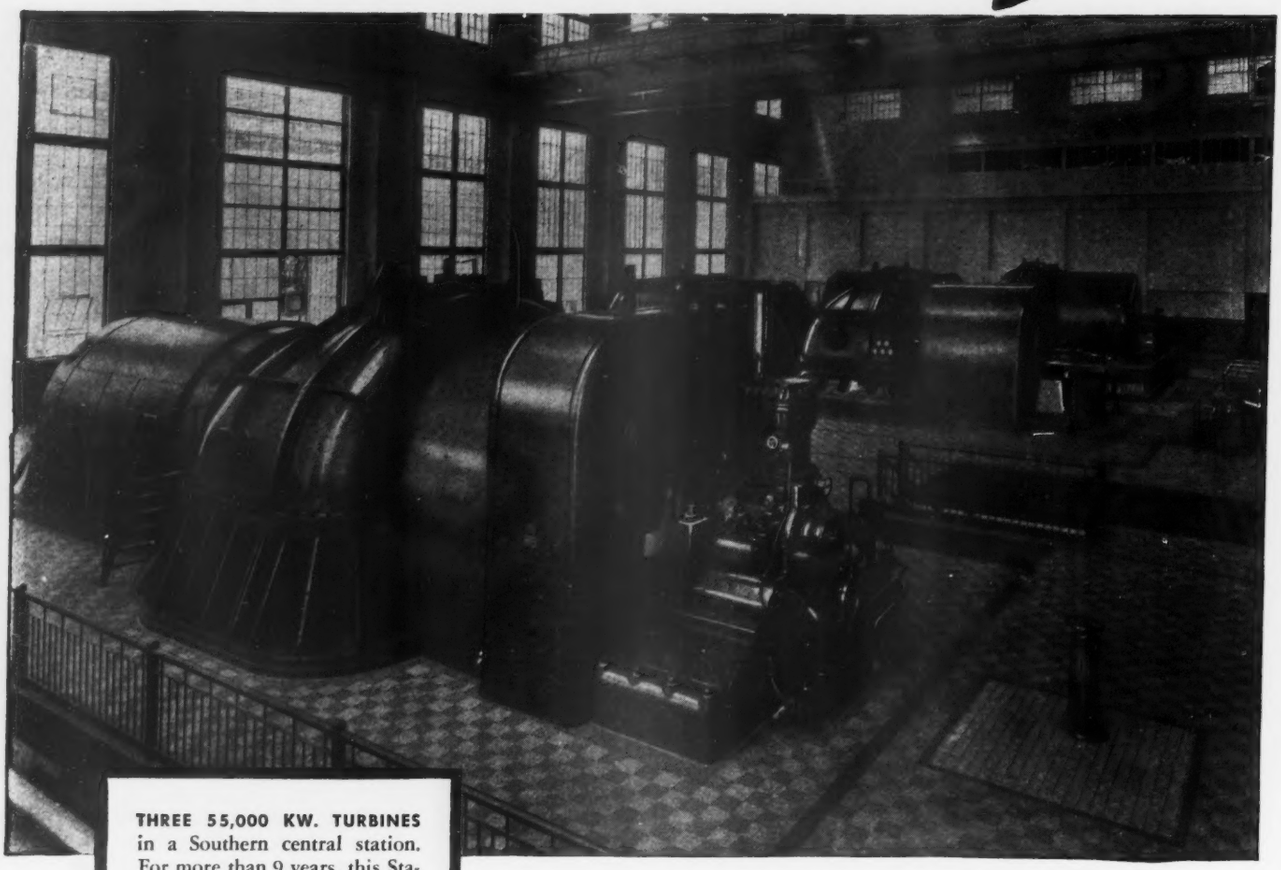
...For electrical buyers who want EXTRA VALUES

SAVINGS ON WAREHOUSING
You can save the cost of maintaining heavy reserve stocks by letting a nearby, well-stocked Graybar warehouse take the place of your own stockroom. You save time and trouble by ordering *everything electrical* through one source.
NO DELAY!
When you need something in a hurry, Graybar's speedy "action service" rushes you the items you need by fast truck delivery. By bringing you needed items promptly, Graybar can help you save by cutting down production losses due to shut-down machinery.
MEN WHO KNOW YOUR NEEDS
They can help you with electrical problems. The average experience of Graybar managers, service managers, and supply department managers is 24.13 years. You put their years of experience to work for you, when you deal with Graybar.
DEPENDABLE PRODUCTS
... the key to efficient maintenance. You can depend on products from Graybar... the products of 200 leading electrical manufacturers. Behind every product stands Graybar's guarantee ...and Graybar's 70 year reputation.
IN 1869 GRAY & BARTON
70th ANNIVERSARY
Graybar
ELECTRIC COMPANY
IN 1939 GRAYBAR

OFFICES IN 83 PRINCIPAL CITIES. EXECUTIVE OFFICES: GRAYBAR BUILDING, NEW YORK, N. Y.

NINE-YEAR SUCCESS

IT'S NOW IN ALL 3



THREE 55,000 KW. TURBINES in a Southern central station. For more than 9 years, this Station has used Texaco Regal Oil.

WHEN one of the larger central stations installed its third big turbine, the question of its lubricant was quickly decided.

For more than 9 years, two earlier machines had given completely satisfactory service, lubricated with Texaco Regal Oil.

Texaco Regal Oils remain stable, separating from air and water, resisting oxidation, emulsification, sludging, year after year.

Thousands of turbines on land and sea are more efficiently lubricated with Texaco.

Experienced lubrication engineers trained in the selection and application of Texaco Industrial Lubricants will be glad to demonstrate that savings can be made with Texaco Perfected Lubrication.

For prompt engineering service and deliveries, phone the nearest of our 2279 warehouses in the U. S., or write:

The Texas Company, 135 East 42nd Street, New York City, N. Y.

Texaco Dealers invite you to tune in The Texaco Star Theatre—a full hour of all-star entertainment—Every Wednesday Night—Columbia Network—9:00 E.S.T., 8:00 C.S.T., 7:00 M.S.T., 6:00 P.S.T.

TEXACO REGAL OILS

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PERFECTED LUBRICATION FOR TURBINES

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MARK OF A GOOD BRUSH

IT INCREASED PRODUCTION 126%

The Osborn Wire Wheel Brush illustrated increased production 126% over the brush used formerly on a job of removing enamel from certain parts of armatures. This worth-while result was gained by an Osborn Brush representative who recommended the right type, diameter and surface speed of the brush and the right gauge of wire. Put Osborn Brushes to work in YOUR plant for comparable results.

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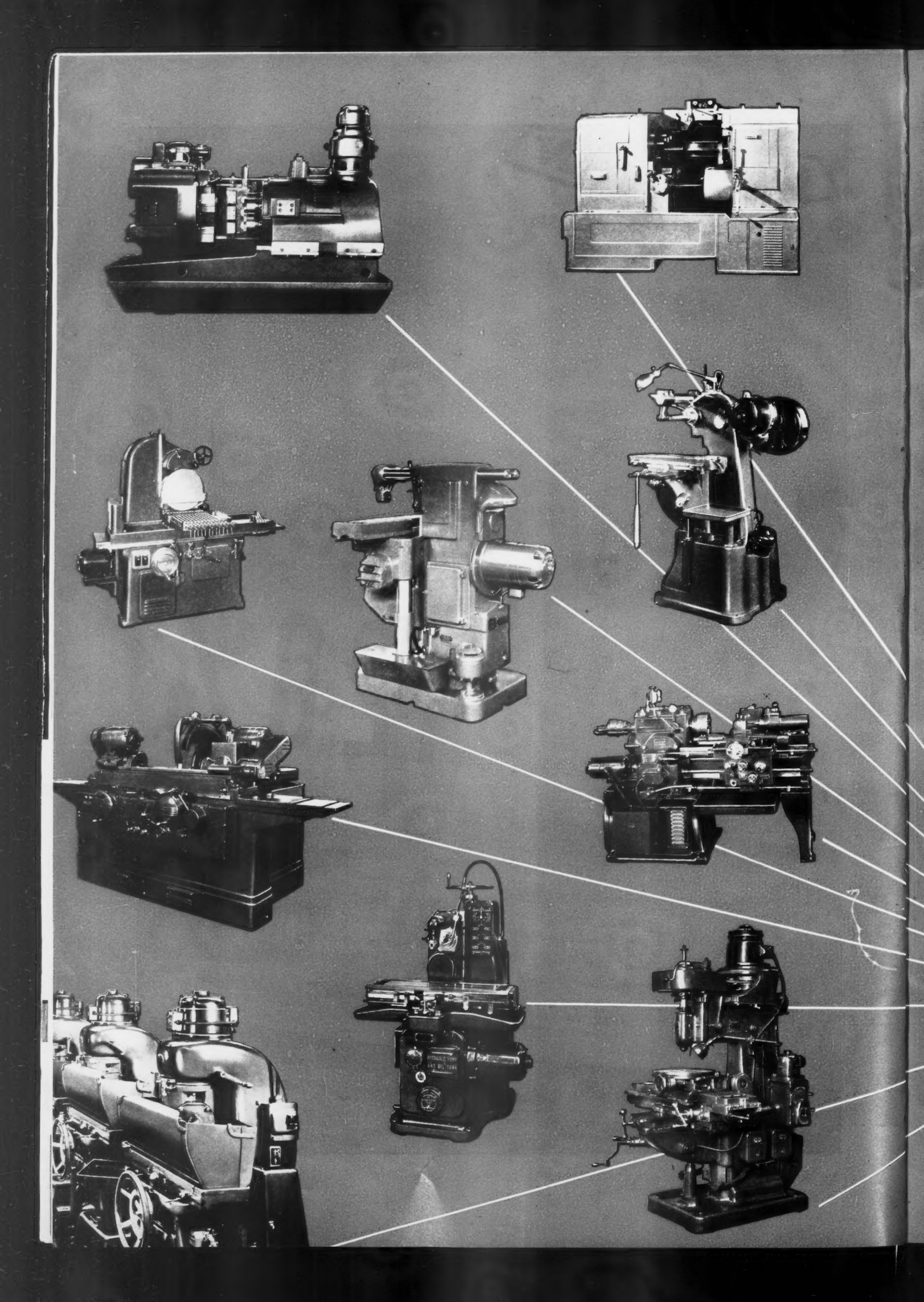
DO IT RIGHT WITH Osborn Brushes AND REDUCE YOUR COSTS



MASTER

makes the job easier

For years, the Machine Tool Industry has been one of the leaders in improving the design, productive output and utility of their products. Smart, alert Machine Tool engineers have been quick to realize how easily they could make their product more compact, lower its cost, and improve its safety, appearance and convenience by using Master motors built to meet their individual requirements exactly.

You, too, may secure these advantages. Investigate Master's unusual ability to serve you promptly and economically with motors in sizes from 1/10 to 100 horsepower, that really fit YOUR needs.

THE MASTER ELECTRIC COMPANY • DAYTON, OHIO

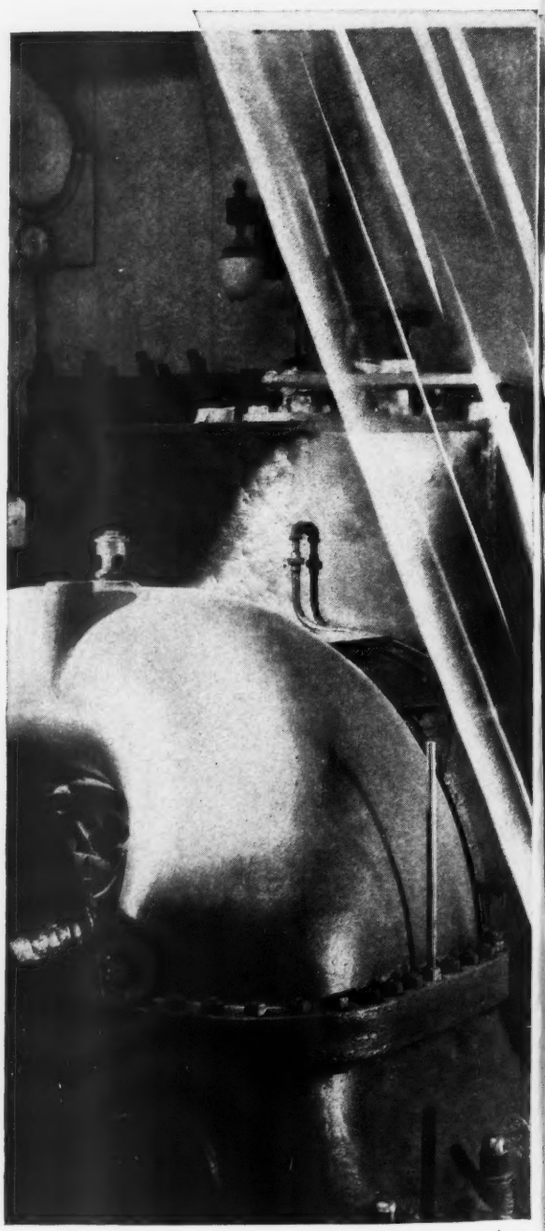
Follow th

GARGOYLE D.T.E.'s PROTECT OVER H

Protecting old-fashioned turbines back in the early 1900's — or new hydrogen-cooled units today — Gargoyle D.T.E. Oils have always set the Standard of Quality. Here's why —

☛ **RELIABILITY — Gargoyle D.T.E. Oils are stable. They help insure uninterrupted operation under all conditions.**

☛ **ECONOMY — These oils help reduce sludging. Even under severe service, one charge often lasts for years!**



THE SOCONY-VACUUM man offers you a complete line of lubricants, plus these *exclusives:*

The right lubricant for every machine . . . and new lubricants ahead of new needs . . . developed by world-famous research laboratories through close cooperation with machine builders.

73 years' experience—thousands of case histories—to guide in prescribing the right use of these lubricants to gain Lubrication Profits for you.

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Another Tough Job for
OIL FILM
Successful operation of every machine depends on the quality of the oil that forms the microscopic coating which helps prevent metal-to-metal contact.

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Industrial Service and Lubricants Help to Lower Costs by

Correct Lubrication

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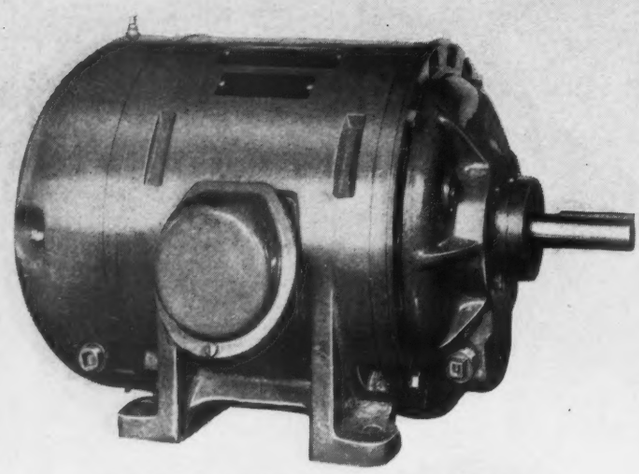
Lubrite Division · Chicago Division · White Eagle Division
Wadhams Division · Magnolia Petroleum Company
General Petroleum Corporation of California

SAVE OUTAGE TIME!



ALL VITAL MOTOR PARTS ENCLOSED

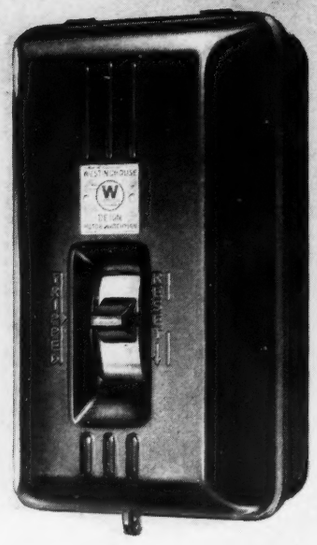
Completely sealed against dust, dirt, moisture . . . Westinghouse dual ventilation gives complete protection of motor parts . . . self-cleaning ball bearings, and all Westinghouse motor features for low-cost operation.

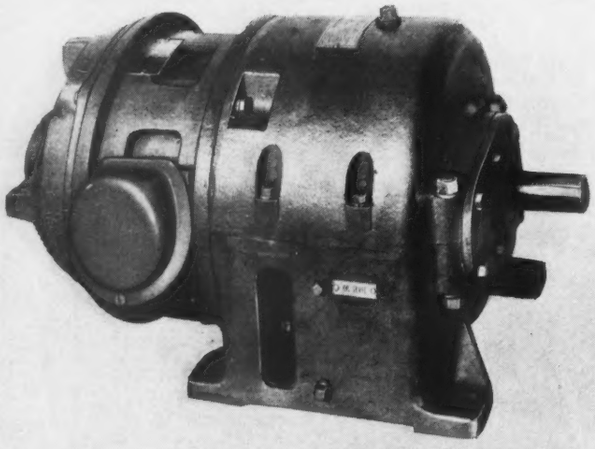
FAN COOLED MOTORS

NEW STARTER FOR MOTORS UP TO 7½ HP

The Westinghouse Motor Watchman has self-indicating handle showing at a glance whether starter is On, Off, or tripped . . . "De-ion" protected contacts and new features that reduce maintenance costs.

"DE-ION" MOTOR WATCHMAN

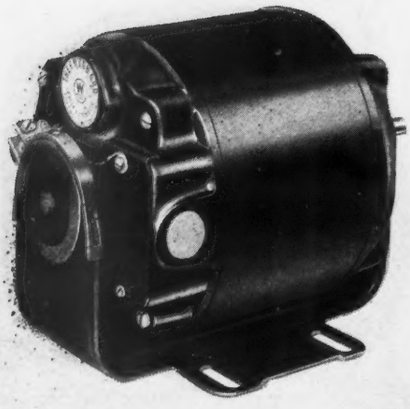




HIGH SPEED MOTOR EFFICIENCY FOR SLOW SPEED DRIVES

Westinghouse gearmotors offer, in one unit, the exact hp needed, at the required speed of the driven machine. One manufacturer, one responsibility . . . specify the hp and output speed . . . that's all.

GEARMOTORS



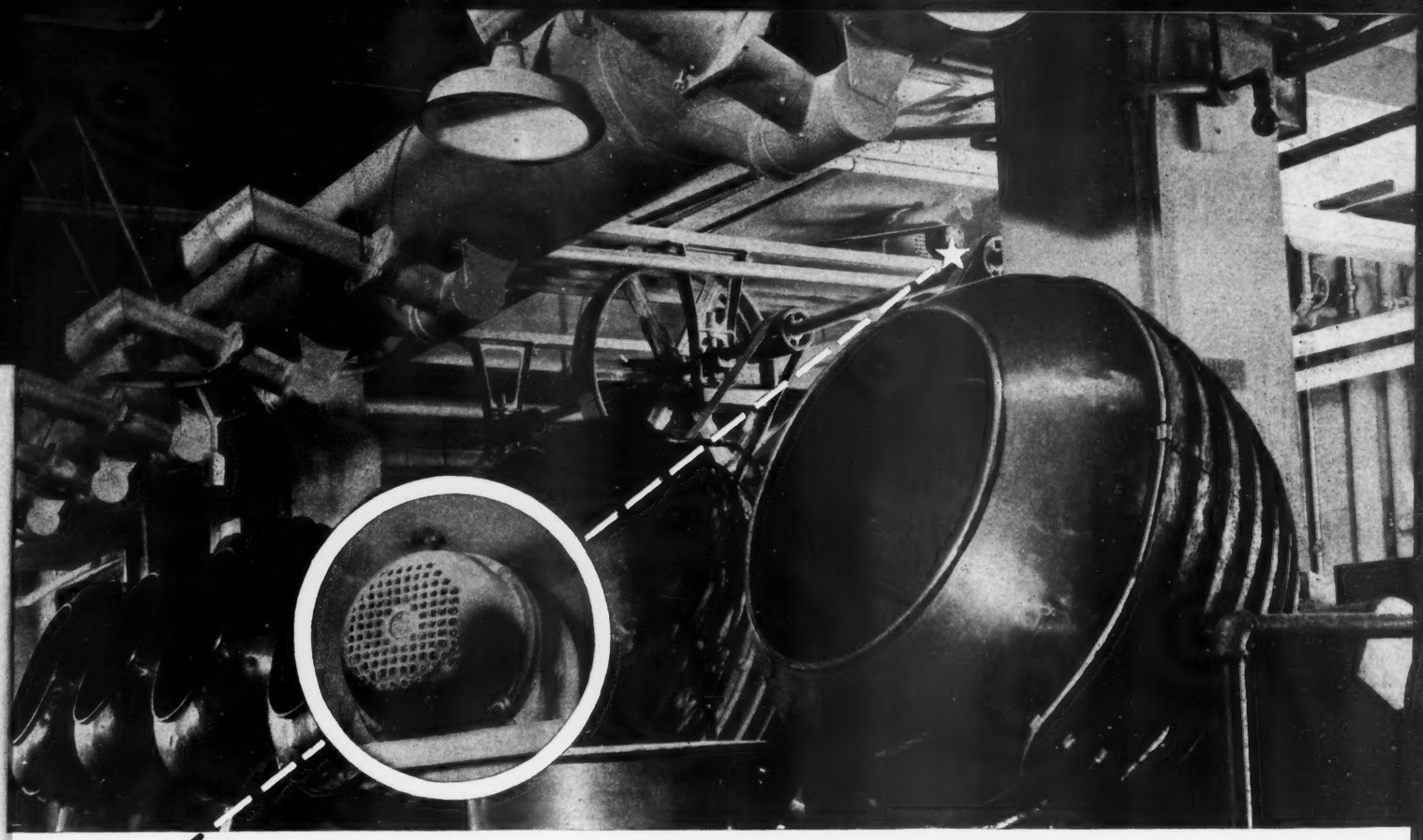
THE "WORK HORSE" AMONG SMALL MOTORS

Westinghouse split-phase motors in ratings from 1/20 to 1/3 hp supply simple, low-cost drives for a wide variety of applications . . . high torque or general purpose. Thermoguard built-in overload protection optional at slight extra cost.

FRACTIONAL HP MOTORS

Westinghouse

W WESTINGHOUSE ELECTRIC



★ GAINED · · *39 Days!*

BY SIMPLE MOTOR REPLACEMENT ON REVOLVING PANS, WESTINGHOUSE HELPS LOFT CANDY COMPANY SAVE 1½ WORKING DAYS EVERY TWO WEEKS

Granulated sugar dust so clogged the drive on six revolving pans at Loft Candy Company's factory that shutdowns were required every two weeks, to dismantle, clean, and reassemble the motor. This lost time amounted to almost 20% of the year's working days — plus repair expense.

Consultation with Westinghouse disclosed that a totally enclosed fan cooled motor, to replace the open one in use, would completely eliminate the trouble. The change was made. Result — 39 working days a year added to productive time, and $106 saved annually in maintenance cost, against a total investment for the changeover of $165.

This typical example shows Westinghouse co-operation with industry — first, to design and build the drive to fit the job — and then to help manufacturers use these latest developments profitably.

Can we help you? Ask our local office, or write Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pennsylvania. Address Dept. 7-N.

J-90201

Motors and Control

VEN

SAVED $

Nicholas F. Mathieu, foundry operator, swears by Venturafin.

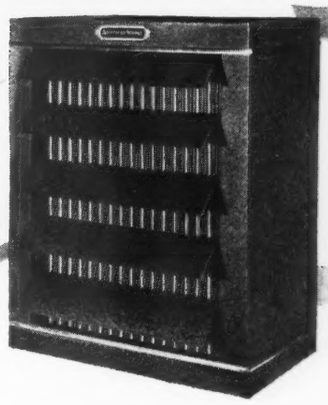
Was "like an iceberg" all winter before Venturafin Unit Heaters were installed. Now the Mathieu & Sons Foundry stays warm and comfortable even in sub-zero weather. Venturafin Units have stepped up production, cut fuel costs over 50%, made winter work a pleasure. No wonder Mathieu men and management agree that "Venturafin Unit Heaters can't be beat."

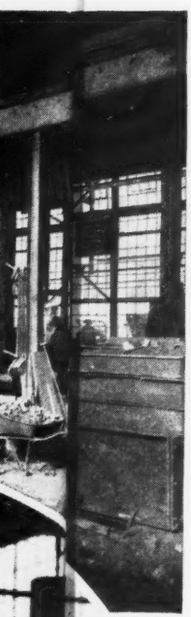
A typical modern plant—big, open, with lots of windows and ventilators—and always "hard-to-heat" until Venturafin Unit Heaters drove out "cold-jitters" and brought solid comfort with annual savings of about $800.

NTURAFIN

D $800 FIRST YEAR

Says **MR. NICHOLAS F. MATHIEU, Foundry Operator**





"In our business we manufacture special irons for special purposes. This necessitates a lot of fast, accurate work. We cannot afford to have 'cold spots,' uneven temperatures and areas that just cannot be heated in zero weather.

"We have never experienced the least bit of trouble with any of our Venturafin Unit Heaters.

"Before we installed American Blower Venturafin Unit Heaters, our moulding sand and core sand often froze. Cold weather often caused shutdowns due to freezing. Now, it is so warm and comfortable in our plant that men work in their shirt sleeves right through the winter.

"Last year, in spite of an unusually severe winter, we burned 290 tons less coal (used only about 172 tons) and had more heat in every section of our plant. *We saved* approximately *$800* in fuel. We figure that the improved working conditions, coupled with our fuel savings and increased production, more than paid the cost of these heaters in a very short time."

(signed) NICHOLAS F. MATHIEU
Mathieu & Sons Foundry Co.
Bridgman, Mich.

Mr. Mathieu's statement is evidence of the two-way savings with Venturafin. Similar savings are being enjoyed by owners of over 145,000 Venturafin Units, heating over 400,000,000 square feet of floor space!

American Blower Unit Heaters have advanced, scientific design and many money-saving, quality features—yet they cost you no more than ordinary unit heaters.

Because the rugged Venturafin Units are designed to new standards of efficiency — delivering 10% to 64% more heat, 4% to 45% more air, with no increase in horsepower—working areas stay warm even in hard-to-heat plants, offices, shops, etc. By eliminating "cold-jitters" and maintaining comfort temperatures, Venturafin builds energy, improves working efficiency!

American Blower Unit Heaters are sold by reliable contractor-dealers everywhere. Look for our authorized dealer seal and get a better product at no extra cost. Buy on easy terms through our affiliate, The Heating and Plumbing Finance Corporation.

Buy VENTURAFIN
High Velocity for hard-to-heat places
Low Velocity for QUIET operation

AMERICAN BLOWER

Unit Heaters

AMERICAN BLOWER CORPORATION, 6000 Russell St., Detroit, Michigan

Division of American Radiator and Standard Sanitary Corp. • In Canada—Canadian Sirocco Company, Limited, Windsor, Ontario

"Who is this man that can cut our operating costs?"

"TAXES are up . . . so are wages and material costs," said the Treasurer. "If we're to make a profit this year, we've got to cut operating costs. Frankly, I don't see how . . ."

The production executive spoke up. "I know where you can get a man who'll show you how. And it won't cost a cent."

"Who is this man?" the Treasurer asked. "Let's get him in . . ."

Two days later the man arrived . . . made a free survey of the plant. As a result of the survey, automatic controls were installed throughout.

Six months elapsed. Then one day the production executive was stopped in the hall by the Treasurer.

"Thanks to your suggestion, we're in the black," said the latter. "Those Taylor Automatic Controls have already paid for themselves—and now we're operating at a nice profit."

* * *

THIS STORY is typical of the way Taylor is helping industry to overcome the problems of today—the problems of higher taxes, of increased material and labor costs.

For Taylor shows you how to attack the one cost which you can reduce—operating cost.

Taylor Automatic Controls can insure the uniformity of your product . . . can reduce spoilage and speed production. This means more sales and greater profits for you.

Write today for a Taylor man to make a free survey of your plant. No obligation of course. Taylor Instrument Companies, Rochester, N. Y. Plant also in Toronto, Canada. Manufacturers in Great Britain: Short & Mason, Ltd., London, England.

Taylor

Indicating Recording • Controlling

TEMPERATURE, PRESSURE, FLOW *and* LEVEL INSTRUMENTS

LET THE *Gilmer* GANG SHOW YOU THE DOLLARS---AND---SENSE SIDE OF...

KABLE KORD

THE Gilmer Gang, backed by engineers who build only belts, are out to get flat belt problems whipped into line . . . Fifteen minutes with a member of this Gang will convince you of the "dollars-and-sense" side to Kable Kord—the 2-in-1 belts that boost production and cut down costs. Here's why Kable Kord is different: Strong *pull-ing cords* and *contactor cords* are welded into a rubber-locked unit protected by a rugged jacket . . . the "pullers" transmitting the load . . . the "contactors" making these pulling cords take a NO-SLIP GRIP on the pulley. The cords are permanently fixed in place. Internal friction is out! Time wasted on taking up stretch is out! Power wasted by slippage is out! Kable Kord's been designed and proven for one out-and-out purpose—to deliver the maximum-power-per-square-inch! Kable Kord comes endless and in rolls.

FOR ANOTHER "PROFIT-PAYING" GILMER BELT, PLEASE TURN THE PAGE . . . .

For multiple drives GILMER "PRECISION-PLUS" V-BELTS with the famous 5 features!

THE Gilmer "V" gets its PLUS POWER from its straight sides that instantly bulge outward—along their entire width—as the belt flexes around the sheave. The steel sidewalls distribute this bulging over both side surfaces, and this sidewall pressure (centered about the strong pulling cords) brings to bear lateral stress across the belt's entire thickness. Thus—the Gilmer V-Belt is *locked* into working position, and the famous NO-SLIP GILMER GRIP goes to work where the belt hugs the pulley. Gilmer Single Strand "V's" for f.h.p. installations have the same 5 Famous Features.

ONLY THE GILMER GANG GIVES YOU 1-2-3-4-5 FAMOUS FEATURES

Gilmer Top Tension Rubber—Tough, resilient. Cuts out costly misfits.

Gilmer Rubber-locked Pulling Cords—Patented construction, concentrating brute strength in thin section, makes cords ride parallel, without twisting, under pressure.

Gilmer Heat-resisting Bottom Rubber — Specially developed by Gilmer engineers to insure cool running at high speeds and eliminate "squashing" in the groove.

Gilmer Heavy Jackets—Protect the belt's vital working parts from oil, dirt, and grease, making Gilmers last three times as long.

Gilmer Controlled Stretch—Pre-tested, to guarantee permanently matched working lengths on every job.

Free Kable Kord Data Book and money-saving facts about "Precision-Plus" V-Belts in the Gilmer Catalogue. Send for your copy today.

L. H. GILMER COMPANY, Tacony, Philadelphia

"The Oldest Firm of Rubber Fabric Belt Specialists"

THEY BREAK THE "LAW" EVERY DAY!

. . . to save **you** *time and trouble*

. . . to provide safety beyond comparison!

MACWHYTE

Braided **WIRE ROPE** *Slings*

THE SAFETY SLINGS

Breaking the law of gravity is a hazardous business. But Macwhyte Atlas Braided Slings are doing it every day all over the U. S. A. . . . doing it to protect workers' lives, to speed handling operations, and to cut handling costs.

SO FLEXIBLE—ECONOMICAL

No other part of the lifting equipment gets the abuse, the abrasion, and the indeterminate stresses that a sling must take. And yet, not only can Macwhyte Atlas Slings "take it," but they're actually safe beyond comparison! Here's why:

1. A Macwhyte Atlas Sling has a sling body exclusively designed for sling work . . .

2. It's made of 2 endless wire ropes of opposite lay (which produces a balanced sling body, one whose parts "cradle" the load) . . .

3. A Macwhyte Atlas Sling is braided to form a flexible, easy-to-handle sling body terminating naturally with eye ends.

NO WONDER THEY'RE SAFE!

Next time you buy lifting equipment, remember this: In a Macwhyte Atlas Braided Wire Rope Sling you get

The flexibility of manila rope . . .

The link principle of chain . . . and

All the strength and dependability of wire rope!

No wonder users say: "the best sling for economical, safe, and speedy materials handling? Macwhyte, of course."

THIS BOOK

. . . Is packed full of information and pictures on all kinds of lifting problems. Send for it NOW.

IN ADDITION . . . Write us about your sling problems. With no obligation our engineers will study them, help you solve them. Write now, before you forget . . . it may save you many a dollar.

MACWHYTE COMPANY • Home Office: Kenosha, Wis.

Manufacturers of Wire Rope and Braided Wire Rope Slings

New York . . . Pittsburgh . . . Chicago . . . Ft. Worth . . . Portland

Seattle . . . San Francisco . . . (Distributors throughout the U. S. A.)

UNIVERSAL SAFETY

Member National Safety Council

NO. 424

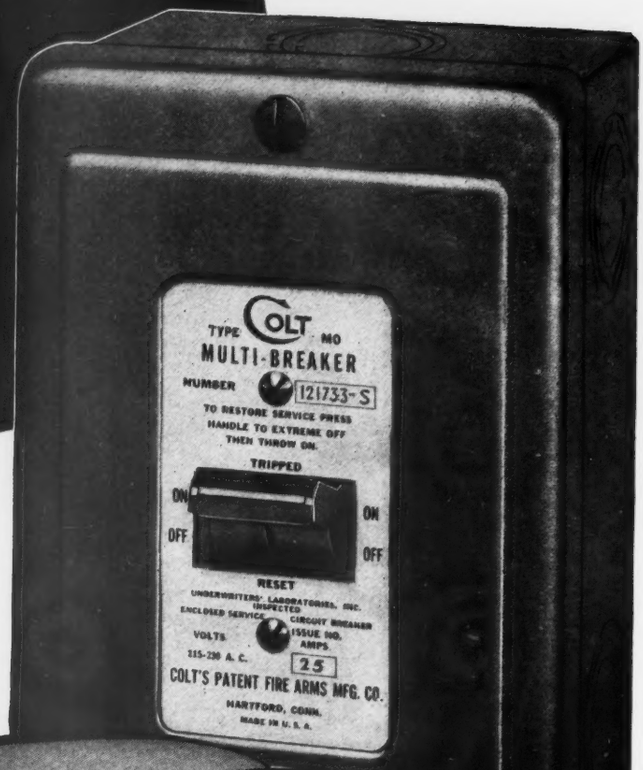
MACWHYTE ATLAS

Braided **WIRE ROPE** *Slings*

NOW YOU CAN HAVE AUTOMATIC PROTECTION

for as little as

$2.00 LIST PRICE



with these *New* TYPE "MO" COLT MULTI-BREAKERS

entirely automatic . . . safe . . . no parts to replace

These new type "MO" Colt Multi-Breakers are available in 15, 20 and 25 ampere capacities . . . 115 or 115/230 volts A. C. They feature the famous Multi-Breaker mechanism . . . operate automatically . . . require the replacement of no parts after tripping. Easy to install . . mechanism permanently attached to cover. They embody the very latest features of small circuit breaker design . . and they will save time, worry and expense in your plant.

Send for Circular Describing "MO" Breakers in Detail

COLT

ELECTRICAL PRODUCTS

MANUFACTURED BY A WORLD FAMOUS ORGANIZATION

COLT'S PATENT FIRE ARMS MFG. CO., HARTFORD, CONN.

ELECTRICAL DIVISION

HOT MONEY

YESTERDAY *one thief* stole more dollars from American Industry than *all* the "stick-up" men took from the public.

This industrial thief is FRICTION. His "hot money" is *your* money—represented in wasted power, rapid wear, costly delays and repairs.

To catch money-stealing Friction red-handed is the job of a group of scientists, engineers and technicians as skilled in their own art as are the "G-Men."

And these "friction-catchers" are at your service instantly, anywhere in America.

Shell keeps a force of them always ready. They are armed with friction-killing lubricants of numerous types and grades. And these Shell specialists have an enviable record for their *arrests* of friction. Thousands of big and little cases on big and little machines crowd their case-history files.

Call in the Shell lubrication man today. There is no charge for his help and no obligation to you.

SHELL

SHELL INDUSTRIAL LUBRICANTS

See your way to extra profits...

Here, better lighting results in greater clarity of fine detail.

with MAZDA H MERCURY LAMPS

Gloom and poor visibility are expensive luxuries which no plant can afford. Human eyes, the plant's most critical control devices, cannot function at greatest efficiency in dimly lighted areas. Employee morale is lowered, production slows down, rejects rise.

You can "see" your way to extra profits with General Electric Mazda H Mercury Lamps. These high-efficiency light sources insure your plant of high seeability, day and night, at a very moderate cost. Dollar for dollar, you get brighter, safer seeing conditions, providing greater eye comfort, greater clarity of fine detail.

For full details about the savings made possible with Mazda H Mercury Lamps, write to the General Electric Co., Dept. 166-FM-J, Nela Park, Cleveland, Ohio.

Order your auxiliary devices, designed especially for this lamp, from the General Electric Company.

GENERAL ELECTRIC

965H

GOES UP FASTER, this durable CUSTOM-MADE VENT PIPE

CORROSIVE LABORATORY FUMES are vented efficiently, at low cost, in the Climax Molybdenum plant, through J-M Transite Pipe. In spite of the variety of sizes used on this job, installation was rapidly completed. For Transite is supplied in a size for every need, with fittings for every construction requirement.

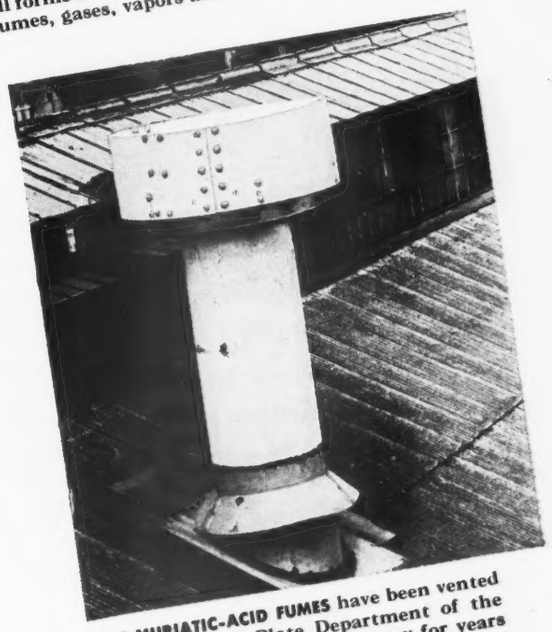
PLATING-TANK GASES have little, if any, effect on Transite "S" Pipe in this large metal-working plant. Made of asbestos and cement, Transite is unusually resistant to all forms of corrosion . . . ideal for venting most industrial fumes, gases, vapors and dust.

AREN'T these the three main features you're looking for in venting systems—easy, economical installation, long life and low maintenance? Then check these features of J-M Transite "S" Pipe—

Custom-made for venting industrial fumes, gases, vapors and dust, Transite is formed under pressure into a tough integral structure free of longitudinal joints. Its long, 13-ft. lengths, complete line of fittings, and the ease with which it may be cut and sawed, speed up installation, cut costs—even in restricted working quarters.

Once up, Transite "S" Pipe offers many other money-saving advantages. Made of asbestos and cement it is uniformly strong, durable and highly resistant to corrosion—provides maximum assurance of long life and minimum maintenance.

Considering all these facts, the cost of Transite "S" Pipe is surprisingly small. You should have complete information before you install your next venting system. Write for Brochure D.S.-336, Johns-Manville, 22 East 40th Street, New York, N. Y.



HOT MURIATIC-ACID FUMES have been vented in the Hot Tin Plate Department of the Hobart Manufacturing Company for years by J-M Transite "S" Pipe. To date, there is no sign of deterioration of the Transite . . . and company officials look forward to many more years of efficient service at low cost.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville TRANSITE "S" PIPE

FOR EFFICIENT, LOW-COST INDUSTRIAL VENTING SYSTEMS

Is Vibration
COSTING YOU MONEY?
Are your machines shaking themselves to pieces?
Is vibration transmission weakening your buildings?

VIBRATION TRANSMISSION is the "bug-a-boo" that is weakening buildings, causing excessive repair bills due to premature wearing of moving parts in machinery and effecting operators' nerves through the actual vibration and noise it sets up.

Felters engineers, working in the research laboratory and in a wide field of actual experience in installing Felters Certified Unisorb* on a great many different types of machinery, have found that Unisorb, installed under machinery, is extremely effective in correcting vibration transmission. Easy to install without ripped up floors or hold down bolts, Unisorb is extremely economical and long-lived.

Send for our illustrated booklet on different types of installations we have made. It may solve the vibration problem for you.

[LOOK FOR CERTIFIED FELT Made by The FELTERS COMPANY INC. Tested under the supervision of our own Laboratory THIS LABEL]

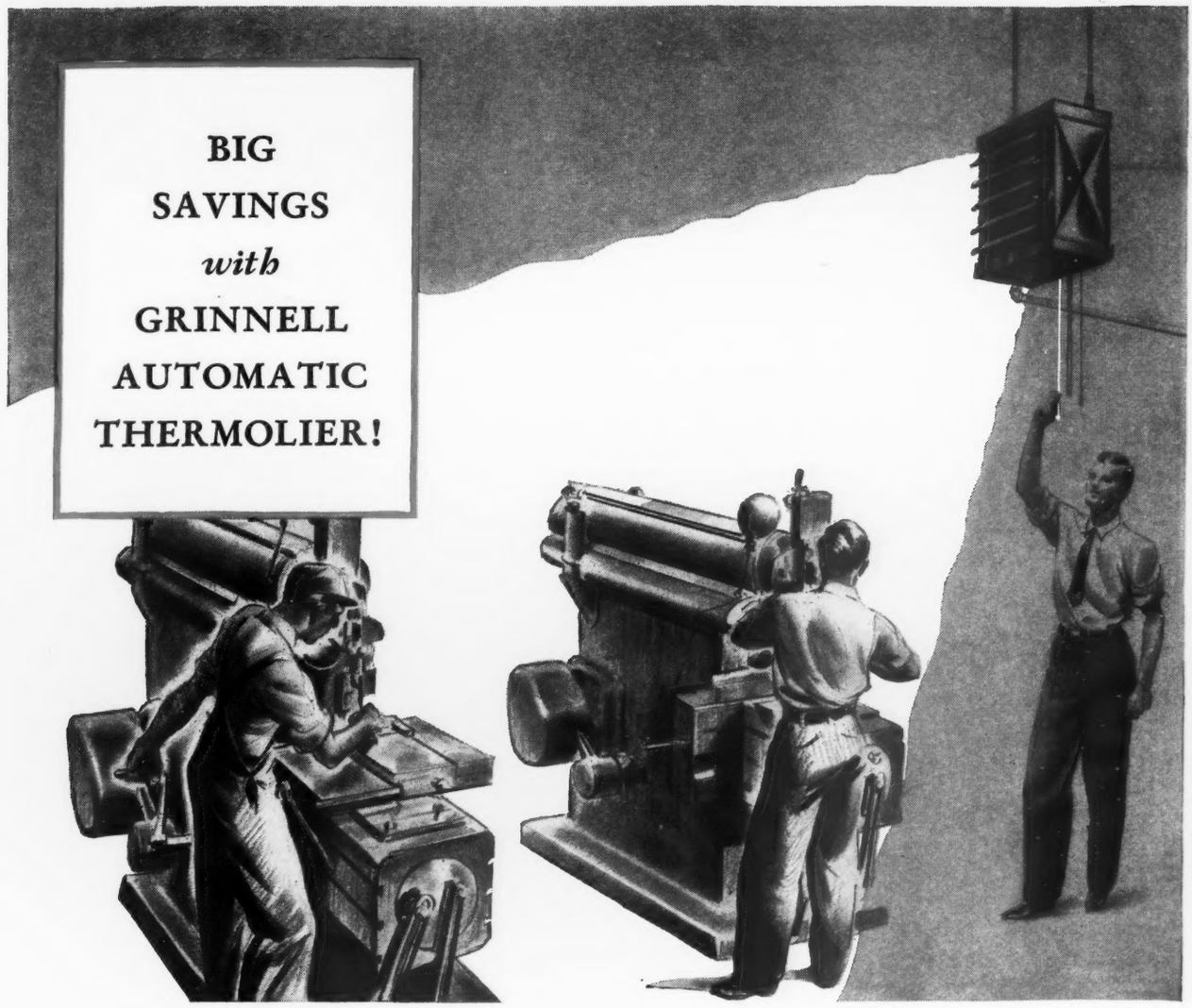
THE FELTERS COMPANY, INCORPORATED

210 SOUTH STREET, DEPT. AB • • BOSTON, MASSACHUSETTS

OFFICES: New York, Philadelphia, Chicago, Detroit, St. Louis *SALES REPRESENTATIVES: Dallas, Los Angeles, Louisville*
MILLS: Johnson City, New York • Millbury, Massachusetts • Jackson, Michigan

* Reg. U. S. Pat. Office

BIG SAVINGS *with* GRINNELL AUTOMATIC THERMOLIER!



Convenient Pull-Cord Setting for Winter Days and Nights . . . and for Summer Air Circulation

Never before has built-in individual automatic temperature control been available in Unit Heaters at a cost so low! Here's thermostatic control that eliminates the expense of special wiring — just tie it into the line. Temperature, uniformly maintained, cuts both current consumption and fuel consumption. And the convenience of the day and night settings makes this Automatic Thermolier outstanding.

Within the unit, two pointers—one for day, one for night—are quickly adjusted over a 60° range and locked by someone in authority. Pull the white cord for daytime temperature—the black cord for nighttime temperature. Summer operation of the fan alone, under automatic thermostat control, takes no extra wiring.

This new and better automatic control can also be installed on your present unit heaters at very slight cost. Write today for full information. Grinnell Company, Inc., Executive Offices, Providence, R. I., Branch offices in principal cities of U. S. and Canada.

ALL THESE AT SLIGHT COST!

- **Hydraulic Action Bulb-Type Thermostat — Can't Corrode*
- **60° Adjustable Range*
- **Adjustable Day Setting for Comfort Heating*
- **Adjustable Night Setting for Tempering Heating*
- **Summer Setting for Automatic Air Circulation*
- **No Outside Wiring of Control*

GRINNELL THERMOLIER

THE UNIT HEATER WITH 14 POINTS OF SUPERIORITY

"That's Great! - but what do you do with regular orders?"

ALLOYS
ANGLES, HOT ROLLED and COLD ROLLED
ARCHES (CORRUGATED)
BABBITT
BANDS and HOOPS
BARS, HOT ROLLED
ALLOYS (HR and CF)
COLD FINISHED
ELECTRIC HIGH CARBON STEEL
REINFORCING
BEAMS and C. B. SECTIONS
BEEF RAIL
BOLTS, NUTS, WASHERS, ALL KINDS
BORING and TURNING BARS and GRINDERS
BRACES, BOILER
CHAIN, ALL KINDS
CHANNELS
CHISELS
CHUCKS, STAYBOLT
CLAMPS, BOILERMAKERS
CLIPS, PATTERSON
CLEANERS, FLUE
CONDUCTOR PIPE
COPPER and BRASS
COUPLINGS, HOSE
CRAYONS, SOAPSTONE
CUTTERS
DARDELET RIVET and MACHINE BOLTS
DRILL RODS
EAVE TROUGH and FITTINGS
EXPANDERS, FLUE
FERRULES, COPPER
FLANGES, BOILER and TANK
FLOOR PLATES
GALVANIZED SHEETS, BARS, BANDS, ETC.
HANDLES, HAMMER
HEADS, TANK and FLANGE
HOISTS, HAND and POWER
IRON, STAYBOLT
LUGS, BOILER, TANK and SILO
MACHINERY, HAND and POWER
MANHEAD PLATES and FITTINGS
NAILS
PACKING
PAINT STICKS
PLATE STEEL, STANDARD QUALITIES
ABRASION RESISTING
COR-TEN and MAN-TEN
PLUGS, FLUE
RAILS and FITTINGS
REAMERS
SHAFTING
SHEETS
ABRASION RESISTING
COR-TEN and MAN-TEN
HOT ROLLED and UNIFORM BLUE
WELLSVILLE POLISHED
COLD ROLLED
STAINLESS STEEL
GALVANIZED and GALVANNEALED
LONG TERNE
CORRUGATED
U-S-S COPPER STEEL
SPRING STEEL BARS and SHEETS
STAINLESS STEEL
STRIP STEEL, CR and HR
TEES
TIRE, ROUND EDGE
TOOLS, HAND and POWER for BOILER and IRON WORK
TROLLEYS
TUBES, BOILER
TURNBUCKLES
VALVES, BLOW-OFF
WELDING ROD and WELDERS
ZEES

USS Scully Service

"A salesman from the Scully Twin Cities Warehouse was calling on a customer when his shop foreman came in and wanted 25 angles within an hour. The Purchasing Agent was peeved. But our salesman said we could make delivery. A phone call resulted in delivery of the material in 25 minutes—in fact before our salesman had left."

"OF course," said the Purchasing Agent, "you naturally wanted to impress me. But, what kind of delivery do you make on regular orders?"

Our representative was glad this question was asked. For each of the eight Scully Warehouses operates on the principle that customers always want their materials prepared and shipped at once. Promptness is the rule on all orders big or little. And when there's an unusual emergency Scully knows that unusual service is needed, so we act accordingly.

That's why thousands of customers all over the country depend upon Scully Service when they want steel, steel products, copper or brass.

Phone, write, or wire the warehouse nearest you. See for yourself why friendly Scully Service has made and held so many friends. And ask for our handy complete Stock List and Reference Book—it's free.

SCULLY STEEL PRODUCTS COMPANY

Distributors of Steel, Steel Products, Copper and Brass

CHICAGO · NEWARK, N. J. · ST. LOUIS · BOSTON · ST. PAUL—MINNEAPOLIS
CLEVELAND · PITTSBURGH · BALTIMORE

UNITED STATES STEEL

"I'M GOING TO CALL THE COPS!!"

● At home workers "do something" about noise. And who can blame a man for *demanding* peace and quiet after a nerve-jangling day in the plant?

How does this noise problem affect you, as an employer? Scientific tests *prove* that excessive noise saps workers' energy — hastens and increases fatigue. And the result is inefficiency—decreased production. Noise strain may reduce a man's output by as much as 30%!

FIGHT NOISE WITH RUBBER

Decide now to fight this costly waste! As an inexpensive first step, substitute *silent* Goodrich Vulc-On Rubber-Tired Wheels for clanking steel wheels on all inside hauling equipment.

No factory noise is more irritating than steel wheels screeching, clumping, and clattering over the floors. That's why your workers will appreciate the *quiet* operation of Goodrich rubber — and unconsciously express that appreciation with increased output, better work.

THEY PAY FOR THEMSELVES

On hauling equipment in your plant, noiseless Goodrich wheels will actually *pay their own way!* They protect floors — reduce damage to loads and depreciation of equipment—cut maintenance costs —speed up handling operations— conserve power.

Long-wearing Goodrich Rubber-Tired Wheels are made in one solid piece of metal that's rust-proof and corrosion-proof. Anti-friction roller bearings assure smooth operation. Tire is *permanently* vulcanized to the rim.

START SAVING NOW!

There's a Goodrich Vulc-On Rubber-Tired Wheel in the correct type and size for every inside truck and trailer. For complete facts on how you will save money with these silent wheels phone your local Goodrich dealer or Goodrich Silvertown Store. Or, send us the coupon below.

Goodrich *Industrial* Tires

THIS GOODRICH VULC-ON WHEEL *Pays its own way!*

The B. F. Goodrich Co. Dept. N-63
Akron, Ohio

Gentlemen: Please mail me (without obligation) your booklet on Goodrich Industrial Tires and information on how they pay for themselves.

Name _____

Company _____

Street _____

City and State _____

Is your wiring WELL DONE?

Take a good look at a simmering strip of bacon and you'll see an accelerated demonstration of one of the major causes of wire failure. Notice how quickly it loses its rubbery flexibility, shrinks, crinkles and even becomes crisp, dry and brittle if you give it too much heat . . . and remember that *the same thing happens to heat-exposed wiring* if it isn't insulated with heat-resistant asbestos as Rockbestos is.

Organic insulation may not curl up under a heat blasting as quickly as a strip of bacon, but it goes through exactly the same process. Drying out, it gradually loses flexibility and becomes so brittle that it cracks, opening paths for moisture and current-leakage. Then comes trouble, equipment outage and an expensive replacement job which might have been avoided if Rockbestos asbestos insulated heat-resistant wire had been used.

If you want to see your electrical maintenance expense take a satisfying drop use Rockbestos, the wire with Ten Tested Values, for heat-exposed, control, power and lighting circuits or heat generating equipment. It is heatproof, fireproof and resistant to oil, grease or corrosive fumes.

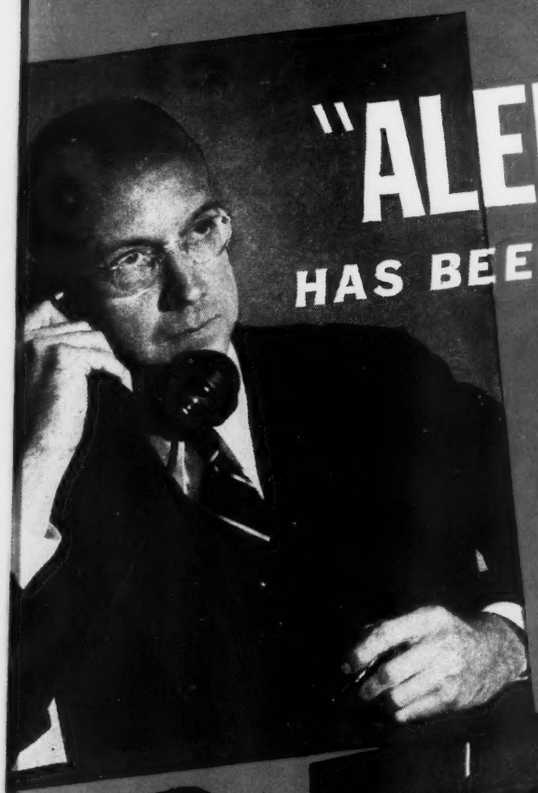
TEN TESTED ROCKBESTOS VALUES

1. Heatproof
2. Fireproof
3. Permanent
4. Lower maintenance cost
5. Resists heat and vibration
6. Saves work
7. Oil and Grease-proof
8. High overload capacity
9. Permanently flexible
10. Greater carrying capacity

Our No. 10-E catalog describes many of our standard constructions and illustrates several typical applications. We'll be glad to send it and free samples, too. Rockbestos Products Corporation, 935 Nicoll St., New Haven, Conn.

Also refer to Electrical World Buyer's Reference

"ALEMITE LUBRICATION HAS BEEN STANDARD ON OUR MACHINES FOR OVER 15 YEARS!"



F. K. SIMMONS, *President*
The Henry & Wright Manufacturing Co.

Insures Positive, Dependable Lubrication — Cuts Maintenance Costs, Says Manufacturer

"Alemite Fittings have been used as standard equipment on our standard dieing machines and steel presses of 50 tons and greater capacity for the past 15 years. We have found the Alemite System highly satisfactory. Alemite No. 33 Lubricant is used to lubricate our machines prior to shipment."

THUS writes the president of The Henry & Wright Mfg. Co., Hartford, Conn., Mr. F. K. Simmons. And he goes on to say that machines so lubricated give *better performance,* require *less service* from the manufacturer and *less maintenance expense* on the part of the user. Previous to the adoption of Alemite Lubrication, these machines sometimes required oiling *four times a day;* now Alemite *twice a day* keeps them operating perfectly.

The use of Alemite Guns and Alemite Fittings is saving millions of dollars yearly for industry! Write for our latest catalog, *"Alemite Industrial Lubrication Equipment."* And feel free to ask Alemite engineers for their recommendations —no obligation!

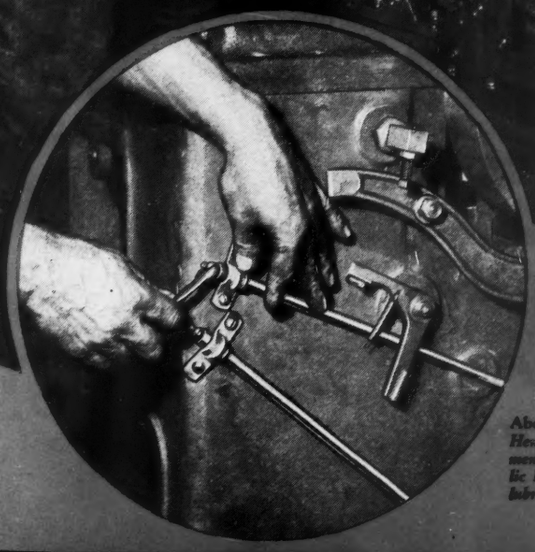
ALEMITE

REG. U. S. PAT. OFF.

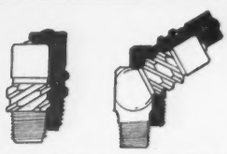
A Division of Stewart-Warner Corporation,
1870 Diversey Parkway, Chicago, Illinois

The Stewart-Warner-Alemite Corporation of Canada, Ltd., Belleville, Ontario

WORLD'S LARGEST MANUFACTURER OF LUBRICATION PRODUCTS



Above: Lubricating eccentric block on Henry & Wright machine prior to shipment. Below: Installing Alemite Hydraulic Fittings on pipe extensions for safe lubrication while machine is in operation.



Alemite Dot Fittings are ruggedly built for heavy duty use; available in different angles and thread sizes; heavily cadmium plated.

Alemite Button Head Fittings are designed for bearings requiring a volume of lubricant, such as heavy machines and contractors' equipment.

Alemite Hydraulic Fittings, world's most popular lubrication fitting for most industrial and automotive requirements; can't leak under pressure.

Alemite Flush Type Fittings meet need where lack of clearance prohibits use of protruding fittings.

Photo by Ewing Galloway

-AND NO ONE TYPE OF ALUMINUM PAINT MEETS EVERY NEED!

That's why Permite paint specialists, working in the world's *only exclusive* aluminum paint plants, developed thirteen different types of Permite *Ready-Mixed* Aluminum Paints to meet the varying paint needs of industry. Each different type, used for its intended purpose, gives a lustrous, long-lasting, metal-like finish that ends the need of frequent repaintings.

PERMITE IS READY-MIXED

With Permite, there is no bother or waste of mixing on the job. Permite is the *successful* ready-mixed aluminum paint, because the pigment is specially treated and stabilized to maintain proper leafing. The Permite pigment is held in workable condition in the can by the exclusive Permite synthetic vehicle. Permite won't harden in the can, won't discolor. Leftovers can be used the next day, next month, next year, without loss of color.

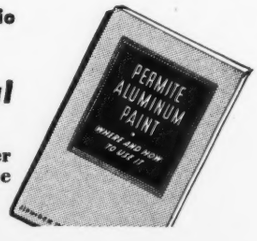
There are 13 PERMITE Ready-Mixed Aluminum Paints

OUTDOOR • INTERIOR • EQUIPMENT
WET SURFACE • QUICK-DRYING
HIGH HEAT-RESISTING
GENERAL PURPOSE MAINTENANCE
FEDERAL SPECIFICATION
PRODUCT FINISHING — 5 *Types*

ALUMINUM INDUSTRIES, Inc., Cincinnati, Ohio
Distributors in Principal Cities

New Permite Paint Manual
TELLS HOW, WHY AND WHERE

One of the most complete manuals ever published on why, how and where to use aluminum paints. It is free to buyers of industrial paints. Write for your copy.



PERMITE READY MIXED ALUMINUM PAINTS

Making a Voltage Survey?

Here's a NEW Recorder for That Job

IT'S INKLESS, IT'S LIGHTWEIGHT, IT'S LOW-PRICED

(ONLY 12 LB)

TYPE CF-1
Voltmeters (also Ammeters)
For Indoor or Outdoor Use
Portable — Pole or Wall Mounting

SPECIAL
FOR VOLTAGE SURVEYS

To attain still higher accuracy over a wide temperature range, Type CF-1 voltmeters are stocked as single- and double-range instruments (rated 0-140 and 0-140/0-280 volts) with temperature compensation for the 0-140-volt range.

THIS new INKLESS recorder —General Electric's Type CF-1—gives accurate, easy-to-read records under all ordinary conditions and also in many cases where ink recording is unsatisfactory. It's a sturdy inexpensive recorder, and its special features make possible many advantages.

NO INK TO SPILL — NO PEN TO CLOG

Because it's inkless, there's no possibility of "painted" or blurred records. No worry about ink evaporation or freezing—you can be sure of successful operation in temperatures from −10 F to 120F. And, under extremely fluctuating loads (where ink recorders would "paint" the chart or blur), you're assured accurate records of actual operating conditions.

WEIGHS ONLY 12 POUNDS

The Type CF-1 is small and light. It is less than half the weight of the conventional recorder. It's easy to carry, easy to handle.

FOR OUTDOOR OR INDOOR SERVICE

You can put these recorders to work inside or outside, as portables, or mount them on walls or on poles. And, where frequent servicing is impractical, they offer the advantage of continuous and service-free operation for as long as 30 days. Complete details are contained in Bulletin GEA-3187. Call the nearest G-E office or write General Electric Company, Schenectady, New York.

HEADQUARTERS FOR ELECTRICAL MEASUREMENT

GENERAL ELECTRIC

430-151

Flat-Belt Drives...

the modern* answer to power economies

Here are the facts—

Flat-Belt Drives Are Most Efficient

On long and medium centers their high efficiency has never been questioned. Same efficiency now possible on short centers with "American" Tension Control Motor Base.

Flat-Belt Drives Cost Less to Maintain

There are fewer wearing parts, no lubrication problems and maintenance requires less skill.

Flat-Belt Drives Cost Less to Operate

On long centers, grouping of drives reduces total connected horsepower one-third. On short centers, with "American" Motor Base, overall efficiency is higher than for any other type of belt drive.

Flat-Belt Drives Cost Less to Buy

The original investment is lower than for other types of drives, as are maintenance and replacement charges.

Flat-Belt Drives Have Wide Application

Installations where flat-belt pulleys may be used most advantageously represent all but a small part of the total horsepower consumed by industry.

"American" Tension Control Motor Bases

No other method produces such high efficiency in short center drives. It automatically compensates for belt stretch and changes belt tension to match load requirements. It eliminates all manual adjustments and will repay its entire cost quickly in reduced power consumption, increased belt and bearing life.

The American Pulley Company are specialists in power transmission engineering. Recognizing modern industry's need for greater economy and efficiency, we are producing steel-split pulleys which fully capitalize all the potentialities of properly engineered flat-belt drives. Because of the completeness of our line of transmission equipment, we and our distributors are equipped to make impartial recommendations to meet any particular problem.

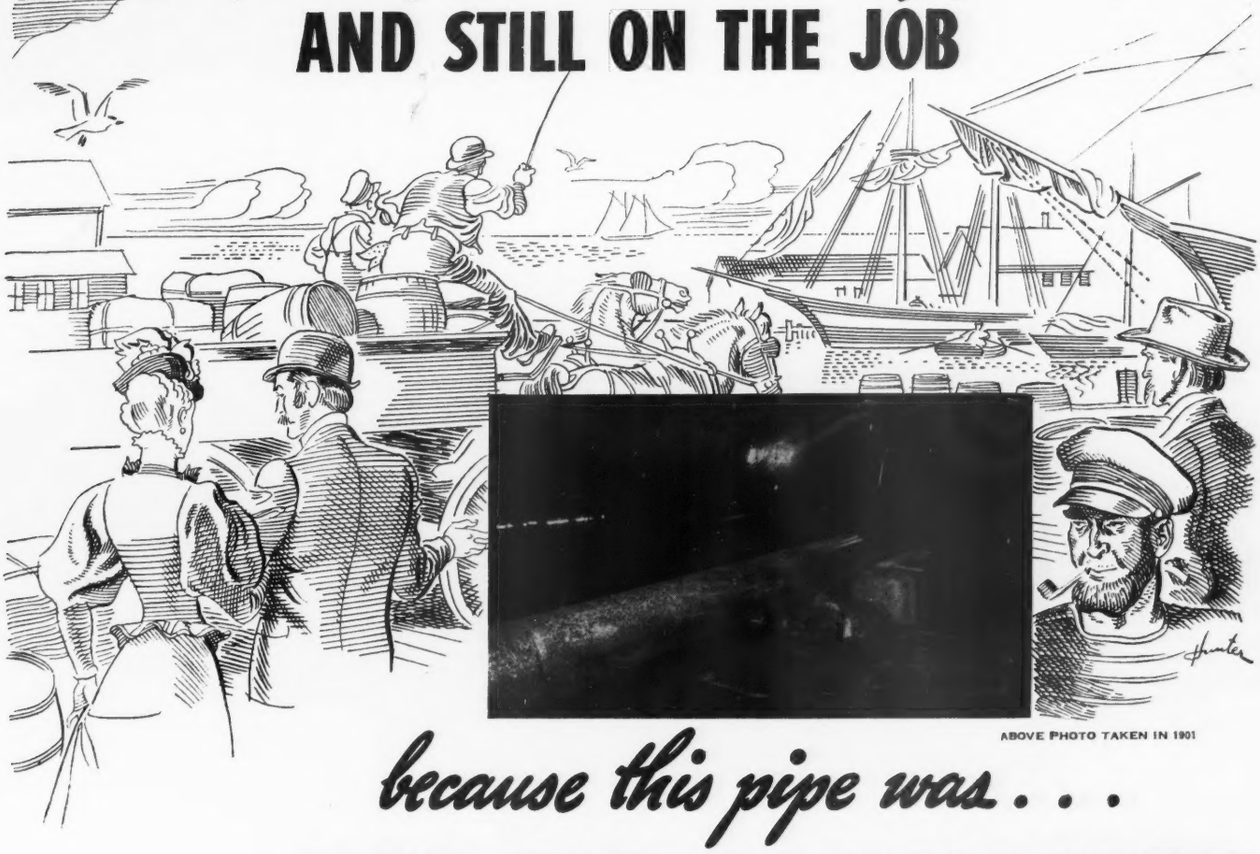
* Many of the newest and most up-to-date plants are principally flat-belt driven. These progressive companies investigated all types, selected flat-belt drives, and are saving money. Write for booklet describing one of these complete installations in detail.

AMERICAN
PULLEY COMPANY

4200 WISSAHICKON AVE. PHILADELPHIA, PA.

In the depths of San Francisco Bay for 37 years

AND STILL ON THE JOB



ABOVE PHOTO TAKEN IN 1901

because this pipe was . . .

HOT DIP GALVANIZED

People often ask, "How long will Hot Dip Galvanizing last?" That we cannot answer; but one example is the pipe above laid across the bottom of San Francisco Bay in 1902 and still in good condition. The cost of Hot Dip Galvanizing it was small but the cost of repairing or replacing it would be tremendous . . . to say nothing of the serious trouble that would have occurred had it failed in its duty of supplying water to the people of this city . . . Where rust is a factor, nothing serves so long for so little as Hot Dip Galvanizing because only the hot dip process guarantees an adequately thick coating of zinc and a union between zinc coating and base metal that makes each an inseparable part of the other. **Patronize** members of this association and know that you are getting **perfect** workmanship and **genuine** Hot Dip Galvanizing on every job . . . Let us send you literature. Address American Hot Dip Galvanizers Association, Inc., American Bank Building, Pittsburgh, Pa.

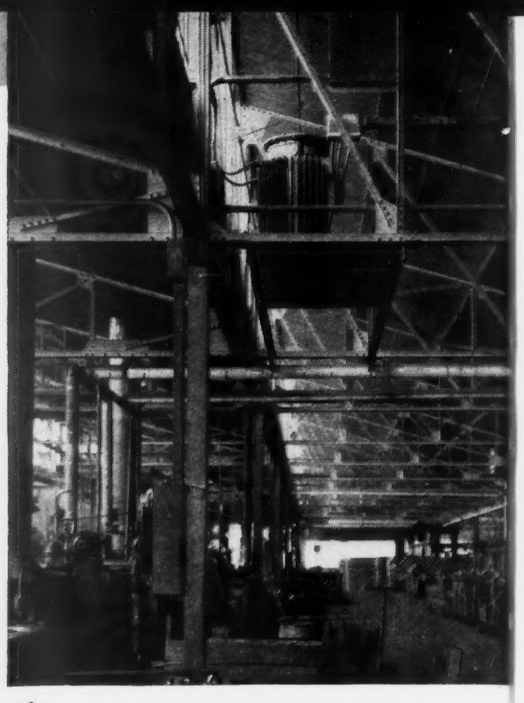
IF IT CARRIES THIS SEAL IT'S A JOB WELL DONE

No. 1 in a series of advertisements featuring the service histories of various Hot Dip Galvanized products . . . FROM OUR FILES—CASE NO. 0937. Water Tube Hot Dip Galvanized by JOHN FINN METAL WORKS, San Francisco—1901.

Acme Galvanizing, Inc., Milwaukee, Wis. ★ Acme Steel & Malleable Iron Works, Buffalo, N. Y. ★ American Tinning & Galvanizing Co., Erie, Pa. ★ Atlantic Stamping Co., Rochester, N. Y. ★ Buffalo Galvanizing & Tinning Wks., Inc., Buffalo, N. Y. ★ Columbian Steel Tank Company, Kansas City, Mo. ★ Diamond Expansion Bolt Co., Inc., Garwood, N. J. ★ The Fanner Mfg. Company, Cleveland, Ohio. ★ John Finn Metal Works, San Francisco, Cal. ★ Thomas Gregory Galvanizing Works, Maspeth, N. Y. ★ Hanlon-Gregory Galvanizing Co., Pittsburgh, Pa. ★ The Hodell Chain Company, Cleveland, Ohio. ★ Independent Galvanizing Co., Newark, N. J. ★ International Derrick & Equipment Co., Columbus, O. ★ Joslyn Co. of California, Los Angeles, Cal. ★ Joslyn Mfg. & Supply Co., Chicago, Ill. ★ L. O. Koven & Brother, Inc., Jersey City, N. J. ★ Lehigh Structural Steel Co., Allentown, Pa. ★ Lewis Bolt & Nut Company, Minneapolis, Minn. ★ Missouri Rolling Mill Corp., St. Louis, Mo. ★ The National Telephone Supply Co., Cleveland, Ohio. ★ Penn Galvanizing Co., Philadelphia, Pa. ★ Riverside Foundry & Galvanizing Co., Kalamazoo, Mich. ★ San Francisco Galvanizing Works, San Francisco, Cal. ★ The Sanitary Tinning Co., Cleveland, Ohio. ★ Standard Galvanizing Co., Chicago, Ill. ★ Wilcox, Crittenden & Co., Inc., Middletown, Conn. ★ The Witt Cornice Co., Cincinnati, Ohio.

Savings like these for you

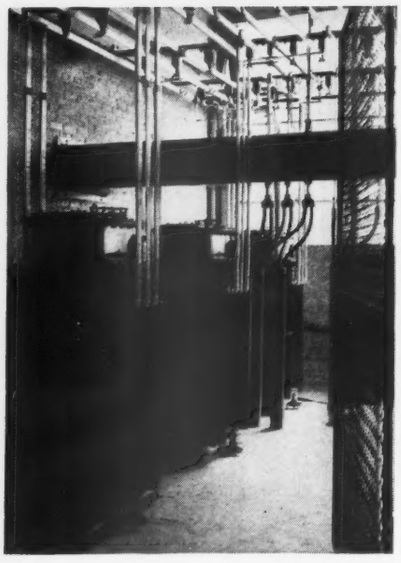
with G-E Pyranol Transformers for Power and Lighting Loads



SAVINGS in installation costs alone will usually make it profitable for you to select G-E Pyranol transformers for all indoor transformer installations in your plant. No vault is required with noninflammable Pyranol, and Pyranol transformers can be installed quickly, easily, and inexpensively.

They can be located near load centers, at any place in your plant—even on overhead platforms. Load-center distribution brings you extra savings by eliminating long runs of secondary copper, reducing line losses, and improving voltage conditions so that lamps, motors, furnaces, and other equipment operate more efficiently.

Find out for yourself how much you can save by specifying Pyranol transformers for your lighting and power circuits. Ask your G-E representative for complete information, or write to General Electric, Dept. 6-201, Schenectady, N. Y., for Bulletin GEA-2637.

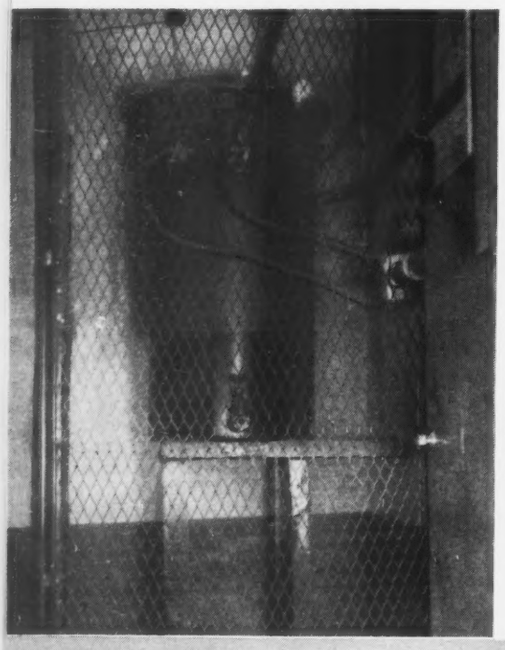


SAVED $500 ON INSTALLATION

"We saved $500 on installed cost by using a Pyranol transformer to supply a lighting load," says R. H. Lewis, electrical superintendent of the Motor Wheel Corporation, Lansing, Mich. This saving represented the cost of a vault which would have been required had an oil-filled transformer been used, plus the value of floor space released because the Pyranol transformer was placed on an overhead platform. Furthermore, by installing the 100-kva, 480–240/120-volt Pyranol transformer right at the load center, the cost of running a heavy three-wire secondary for 500 feet was avoided.

AVOIDED COST OF UNDERGROUND VAULT

The Byron Jackson Company, Los Angeles, selected Pyranol transformers for this 600-kva bank because the use of oil-filled transformers would have necessitated the digging and lining of an underground vault in the production area of the plant. The Pyranol transformers fit into space that could not be used for production. Again, there were savings in installation costs and floor space. These transformers, supplying power for the testing of horizontal pumps driven by 2300-volt motors, are rated 2400–240/480 volts and are used as step-up units.

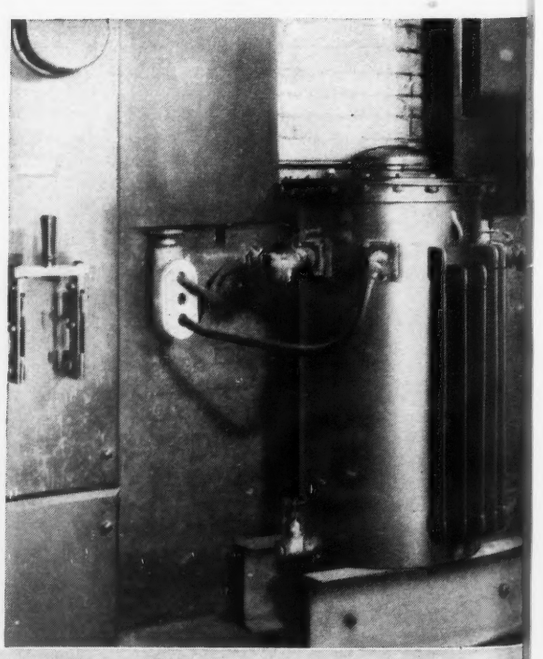


CUT COPPER COSTS IN HALF

This Pyranol transformer supplies power for the lighting system in the new recreation building of an Alabama cotton mill. Here, noninflammable Pyranol made possible an indoor installation that saved 50 per cent in the cost of copper for the lighting circuits. Better voltage conditions resulted from the installation of the transformer near the load center.

SAVED $163 ON LIGHTING MODERNIZATION

This Pyranol transformer saved $163 for the Allied Paper Mills, Kalamazoo, Mich., when the plant lighting system and lighting circuits were modernized. In addition to the original installation savings, the location of the Pyranol transformer at the load center eliminated long runs of secondary copper, reduced line losses, and resulted in improved voltage conditions on the lighting circuits. The transformer is rated 75 kva, 460–115/230 volts.



GENERAL ELECTRIC

300-83

ACME TOOLS

A few of the 429 Acme tools and accessories which enable more than 20,000 users of Acme Steelstrap to effect maximum economies

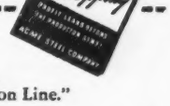
—FOR MAXIMUM *Steelstrapping* ECONOMY AND SPEED

The tools and equipment used in *manufacturing* your products are selected because they do the job most economically and efficiently. Steelstrapping, too, can provide maximum savings, afford the greatest protection, and require the least amount of time and effort *when the right tool is used for each individual job.*

The Acme *Process* includes a complete line of tools and accessories. There is an Acme tool for every packing purpose, whether in the reinforcement of parcel post packages or carload shipments. Some tools tension the strap, others seal the joint, while still others combine these functions in one piece of equipment. In addition, there are accessories, tailor-made for the specific production and handling requirements of individual shippers.

The Acme analyst will be glad to demonstrate the Acme tool which will provide maximum advantage for you. Ask to have him call, or mail the coupon for the new 22-page booklet describing the advantages of the Acme *Steelstrap* Process, the Acme *Unit-Load* Process and the Acme *Skid-Load* Process.

MAIL THE COUPON FOR YOUR FREE COPY OF *"Stopping Profit Leaks"*



ACME STEEL COMPANY
ACME *Steelstrap* PROCESS
2831 ARCHER AVE. • CHICAGO, ILL.

ACME STEEL COMPANY
2831 Archer Ave., Chicago, Ill.

☐ Have the nearest Acme analyst call.
☐ Mail a copy of the new 22-page illustrated booklet, "Stopping Profit Leaks Beyond the Production Line."

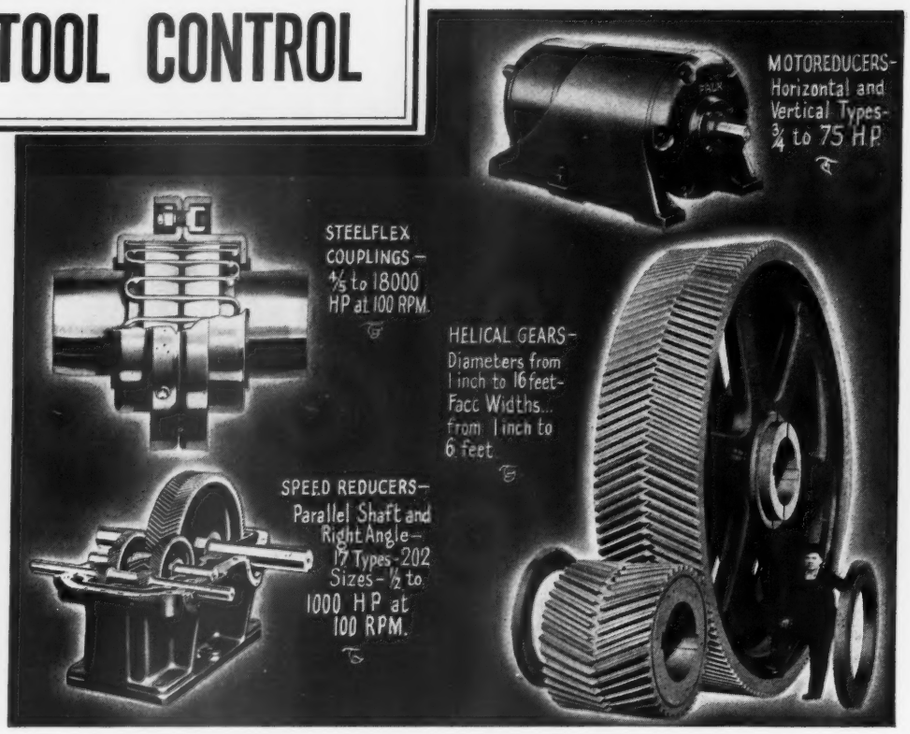
Name.....

Address.....

City.....*State*.....

Saving $50,000 with McCASKEY TOOL CONTROL

Some of the FALK products



HOW THE FALK CORPORATION, Milwaukee manufacturer of herringbone and helical gears, speed reducers and increasers, flexible couplings, and large marine turbine and Diesel drives, reduced tool costs by modernizing their tool service, told by Mr. Harry Green, Machine Shop Supt.:

"After eight months operation with McCaskey Tool Control, our tool activity records were used to set minimum quantities of tools to be carried. This resulted in a reduced inventory of most items.

"Gearing tools, for example, were cut from $4228 to $2239, drills were cut from $9000 to $7000, facing bars from $4080 to about $1500, chasers from $6000 to $3500, and end mills from $2800 to $1600.

"Purchases were cut down throughout the period, as we were using up tools to reach the minimum. Since this resulted in a dollar saving in excess of $50,000 for tools and supplies, it can be seen that the result was well worth while, considering the small investment involved."

Every step of their program leading up to this saving, together with other advantages derived, are outlined in a six page report entitled "Falk Installs Modern Tool Crib Control". How tools were rearranged, how bins were numbered, how the activity report is provided, how tool standards were adopted, and many other facts of interest are given in detail.

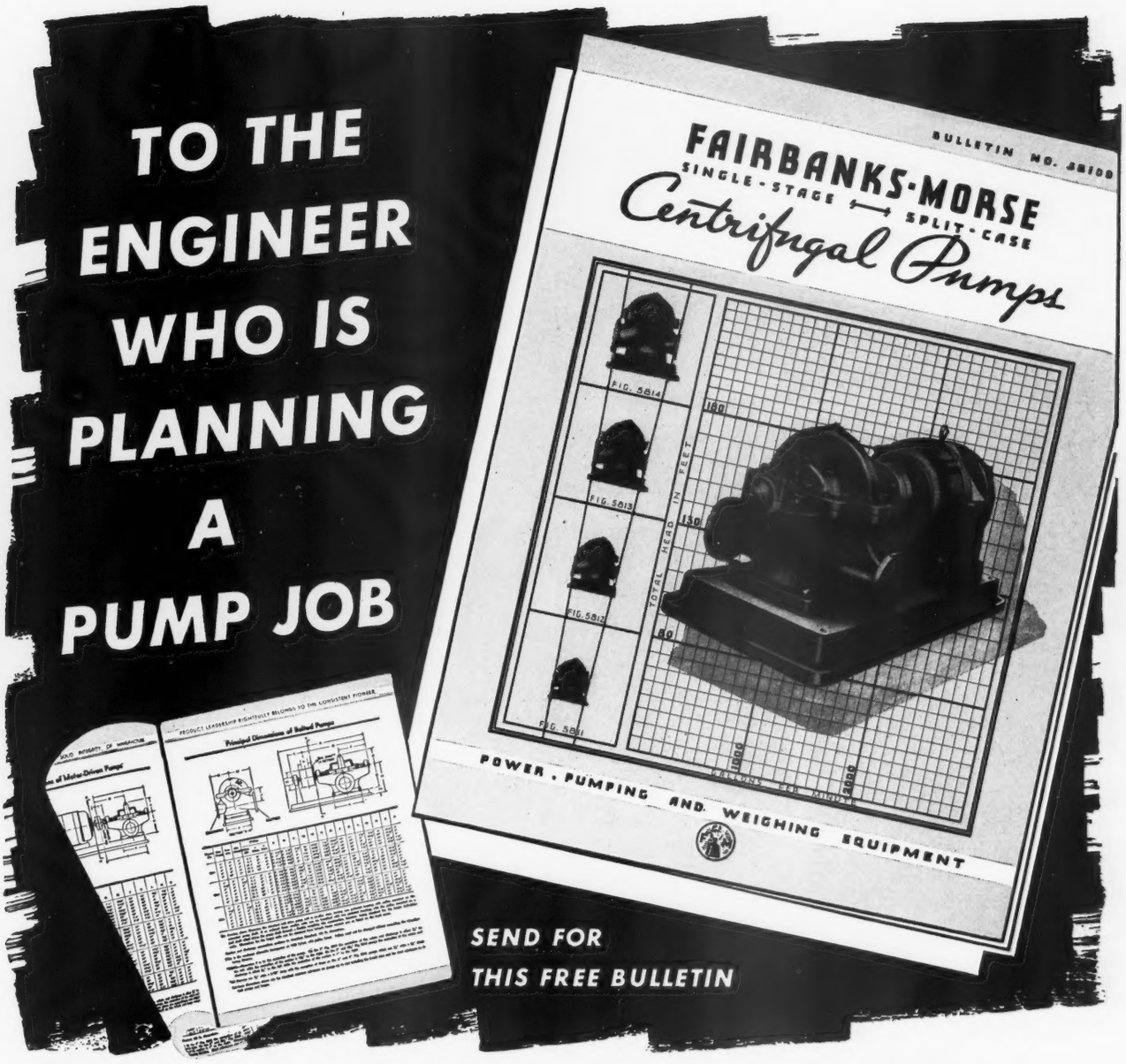
Your manufacturing requirements may not be at all similar to those of Falk. You are overlooking a spot where real savings can be made, however, if you fail to consider modernizing your tool crib control. Write today for a copy of the report and other data concerning McCaskey Tool Control.

McCASKEY REGISTER COMPANY, ALLIANCE, OHIO

McCASKEY INDUSTRIAL CONTROLS

PRODUCTION • INVENTORY • MAINTENANCE • TOOLS • COSTS • PAYROLL

TO THE ENGINEER WHO IS PLANNING A PUMP JOB



SEND FOR THIS FREE BULLETIN

When you are planning a pump job, it is a great convenience to be able to pull from your files complete technical information which enables you to visualize quickly the type of pump needed. Fairbanks-Morse bulletin 5810D is designed to give you this information on the F-M 5810 line of single-stage, split-case, centrifugal pumps. This line provides capacities up to 6000 G.P.M. designed for heads up to 280 feet at 1750 R.P.M. Bulletin 5810 enables you to choose the proper pump for your job, refer to dimensions on another page, and then to make your plans with exactness and precision—no guessing. It will be sent to you without charge and without obligation upon request. Address: Fairbanks, Morse & Co., Dept. 30, 600 S. Michigan Ave., Chicago, Ill. Branches and service stations throughout the United States and Canada.

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FAIRBANKS SCALES
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WATER SYSTEMS
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FARM EQUIPMENT
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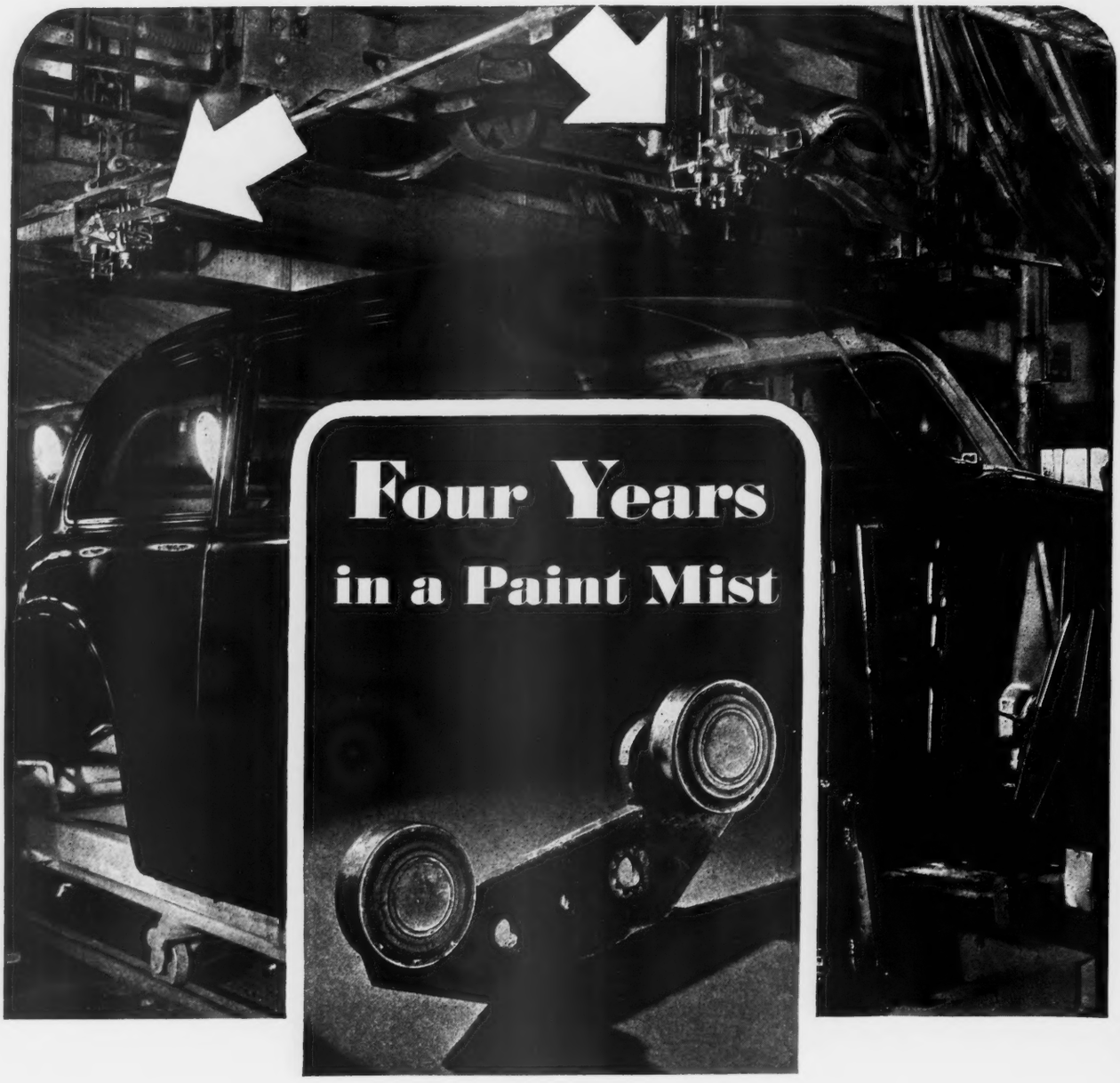
Pumps



OIL or grease is "poison" to duco, yet bearings must be lubricated.

Operating in a mist of duco spray is an abnormal condition usually considered too severe for any anti-friction bearing. But this instance serves to emphasize the effectiveness of this self-sealed, self-lubricated bearing by New Departure.

Here the bearings function as wheels on carriages which support a series of spray nozzles that traverse the width of automobile body tops as they move forward on conveyors.

Even though heavily encrusted with duco, these bearings were found to be operating successfully after four years of continuous service.

It pays to buy sealed bearings from New Departure, who originated the self-sealed, self-lubricated bearing—and whose products are *ideas* as well as bearings. 2801

NEW DEPARTURE *N-D-Seal* Bearings

New Departure • Division General Motors Sales Corporation • Bristol, Connecticut

NOTHING ROLLS LIKE A BALL

AFTER FOUR WEEKS OF WAR

What Is Ahead for American Industry

Editor's Note: *In this fourth "Factory War Communiqué" we present a brief digest of what has happened to industry since the outbreak of war. More important, however, we indicate something of the outlook and especially the tremendous implications to American industry if we are drawn into the conflict*

PERSPECTIVE First a short glance back to 1914. Then a brief scrutiny of the troubled present. Finally, a good realistic look at what's in store for us if we go to war. And from them all—perspective. In a world of such uncertainty, predictions are futile. But perspective helps to appraise the kaleidoscopic shift of events, here and abroad. And it emphasizes a few of the eternal industrial verities, stresses the need for caution in "war boom" talk, points a warning concerning the "economic straightjacket" (General Hugh Johnson's phrase) which Mars has prepared for American industry, should we decide to wade into the argument overseas.

THEN The First World War was three weeks old on August 25, 1914. The New York Times reported gloomily that unemployment and business failures were on the increase. The Stock Exchange was shut tight. Commodity prices had embarked on a ten-week skid, although wheat and sugar were doing well against the trend. Shipping was at a standstill but there was no talk in the papers about submarines. Abroad. Lord Kitchener startled the House of Commons by predicting that the conflict might last three years. To America, the struggle still seemed remote and rather incredible. We were in the midst of a depression and the war simply made it worse. Bewilderment was uppermost in the minds of business men. A few bright spots were noted, but the general dullness of industry and commerce was destined to prevail for almost five months. By October, 100,000 steel workers were jobless in the Pittsburgh area alone.

AND NOW Here are some of the yardstick measurements of the first three weeks of the new World War. Last week the stock market was buoyantly holding most of its surprising September gains at a high of 111.96—2.31 points below the previous week, but 13.29 above the same period in 1938 and 3.54 points below the 1937 figure of corresponding date. The *Business Week* weekly business index made its third consecutive gain to 114.9—6.2 above the previous week, 25.5 above the same week of last year but still nearly 10 points below the July, 1937, peak. The commodity price index stood seven points above the August average which, in turn, was a 1939 high.

September industrial production was estimated by

The Annalist (N. Y. Times) at 110—8 points above the unexpectedly good July-August levels. Carloadings, at 805,733, were only 4 per cent below the 1937 top. Retail sales were up three points for the four weeks ending September 16 (which included some August gains). Crude oil production spurted 968,336 barrels a day, nearly 30 per cent above the 1938 period. The steel mills called 50,000 men back to work as estimated operations leaped 9.1 points in the week of September 16 alone, indicating 79.3 per cent of capacity, the best mark in two years. Orders and inquiries mounted, promising jobs for 75,000 more by Thanksgiving. Some mills were booked through the fourth quarter. Bank clearings gained steadily. Power output passed its 1937 peak.

Here are some of the "weathervane" developments of the same period: The Maritime Commission called for bids on 33 new ships, speeding up its 1939 building program 66 per cent. Aircraft plants, aboom with U. S. and foreign government orders, boomed anew, the foreign buyers taking their chances on Neutrality Act revision to permit shipment. Machine tool centers, already close to capacity, met a new buying wave—domestic, Canadian, and European. Many went into three-shift production and were forced to extend delivery dates. Some price increases were visible. Calls for every type of machine were reported, indicating that industrial plants were making long-delayed capital investments.

In Washington an informed authority predicted that Allied buyers would soon be asking U. S. manufacturers to accept orders for munitions—Neutrality Act or no. Our War Department was not expected to object because of the "educational" nature of the work. Plant expansion plans received definite government encouragement when RFC announced that "special consideration" would be given loans for this purpose. Railroad appropriations for improvements and new equipment were estimated at $125,000,000.

Abroad, the warring nations were frankly cutting their cloth for a long struggle as the ill-armed but valorous Poles collapsed—much sooner than did the ragged Russians on whom the Allies banked so heavily in 1914.

Here at home, the Second World War was anything but remote. Indeed, there was talk of American participation (undreamed of in 1914) and many a Washington insider guessed "six months." Congress gathered for a special session fight over Neutrality Act revision. The stock market warily edged upward on the day of President Roosevelt's "cash and carry" plea—displaying the rare phenomenon of a favorable Wall Street reaction to a presidential speech. Embargo repeal was the Administration's sole aim as the session started. But anti-profiteering legislation was not completely out of the picture.

TWO BIG DIFFERENCES

All this in three short weeks! Much of the difference between America, 1914, and America, 1939, seems chargeable to the "experience factor." The world—and America with it—was digging in for war long before war began. In 1914 nobody, here or abroad, realized that modern warfare meant a gigantic, prolonged clash of industrial economies in which the military forces were merely the spearheads. Any estimate that the destruction at the point of impact would cost the nations $122,000,000 a day (which later it did) would have been dismissed as fantastic. Now everyone knows what war means. The actions and reactions of world war have thus been streamlined and telescoped in breath-taking fashion.

That is one big difference. Here is another. As FACTORY pointed out last month, the United States was in the grip of a depression in 1914, whereas last summer it was on the verge of a very positive upturn. Throughout August, manufacturing, steel operations, carloadings, and power production showed good gains. Combined all-August business indices ran 10 points ahead of 1938. Raw materials inventories for July were 19 per cent below those of April, 1938. The evident discrepancy between inventories and production seemed certain to spur further revival despite cautious buying. When the war broke out, the pick-up was undoubtedly accelerated by price increases and the fear of price increases, plus the prospect of foreign orders. *But we must assume that the cycle of pronounced activity, already in the making, would logically have continued, war or no war.*

OPTIMISTIC UNCERTAINTY

To this cycle add certain factors (a "long war," Neutrality Act revision, etc.) and you get a boom—or what passes for a boom nowadays when something tugs sharply at the deadweight of our surplus commodities and unemployment. Or from the cycle subtract any one of the many political and military eventualities that may change the course of events in Europe. Then you get optimistic uncertainty, the prevailing American mood of the moment.

From any boom, subtract the fact that corporate offerings of new securities are still extremely slow, that the attitude of management toward plant expansion is one of serious skepticism, many operators declaring flatly that they will not saddle themselves with new debts and taxes unless amortization is plainly in view at the outset. Remember that some lines suffer (tobacco, for example) as much as others gain.

Last week a Connecticut brass plant raised wages while an Ohio cash register concern cut executive salaries—both because of the war. Remember that the increase in South American exports may be sharply offset by the loss of other markets. Case in point is the British ban on hundreds of items of import from clocks to umbrellas, including some important lines such as household appliances and passenger automobiles. Remember that price rises may be nipped by federal legislation, that profits on foreign orders may be held down by collaborative buying by the Allies. (The first French purchasing agency was set up in New York last week. As for the

British, it is known only that the Morgan firm will not act for them this time.)

Remember that actual foreign orders are still largely in the "paper stage." Rumors of real buying are very hard to pin down. Three of the largest American firms in a field where such orders would be expected say they have received none so far. An outstanding economist observed last week that the upturn cycle (had no war begun) would probably have been within five per cent of the current recorded activity. And remember, above all, that a war boom will last only as long as the pocketbooks of the Allies. To be sure, they have reserves here now of at least $5,000,000,000. But Great Britain's *per capita* debt is three times ours while France's position is even more precarious. And the Johnson Act stands in the way of our selling ourselves bonds to pay ourselves for their purchases, as we did before.

BUSINESS STATESMANSHIP TO THE FORE

In industry's early price policies of September was born the phrase "business statesmanship." There was a definite inventory scramble at the start but panic buying was quickly checked. "Runaway" prices do not now seem likely. Reassuring were the price stability declarations of Monsanto Chemical, Lincoln Electric, and the American Retail Federation. The caution urged by the National Association of Purchasing Agents was credited with a steadying effect. There was statesmanship, too, in the United States Chamber of Commerce warning against over-enthusiastic acceptance of the "war boom" theory. And there was statesmanship of the highest kind in industry's general reaction to the idea of war itself.

THE INDUSTRIAL MOBILIZATION PLAN — A PLEA FOR PEACE

Henry Ford was not, this time, the only industrialist who declared war on war as soon as the war began. Last week, the prospect of American participation—so fantastic in 1914, so real today—caused many a business leader to peer over the precipice and issue a solemn warning. Said Charles Belknap, vice-president of Monsanto Chemical: "War means years of economic blackouts . . . Business in general will lose when this or any other major nation bears arms."

Said Howard Coonley, president of the National Association of Manufacturers: "Economic chaos and years of crushing depression are war's inevitable aftermath. War imperils representative democracy." (Meanwhile, the Gallup poll spied a war cloud considerably bigger than a man's hand on the horizon of public opinion. Sixteen per cent of Americans, so the poll showed, already favored armed intervention in Europe. And the greatest opposition to war came from those in the higher income brackets, the least from the lowest paid.)

Apart from the natural humanitarian reasons, industry had good cause to peer dubiously down the road to war. *Among the sombre consequences of modern warfare is stark totalitarianism, for the period of the conflict at least.* The absolute regimentation of civilian life, the complete submersion of the individual, the conscription not only of man-power, but of wealth and business ability loom today as probabilities of war. It is so ordained in the War Department's well-wrought Industrial Mobilization Plan.

This document represents 20 years of study and preparation by military officers who visualize war as an effort involving alike "the soldier in the most forward line and the humblest citizen in the remotest hamlet in the rear." To them, rightly, "effectiveness is mandatory." The possibility of post-war economic collapse and political upheaval is something for civilians to worry about. And it is not too soon for every responsible man in industry to recognize the gravest implications of this plan.

A totalitarian economy calls for a dictator. The Industrial Mobilization Plan would make the wartime President of the United States a dictator of titanic stature, master of the economic and personal destinies of one-seventh of the earth's population and nearly half its wealth.

A dictatorship calls for legislative authority. Part of the needed authority exists already. Few realize the extent of the powers made available to the President, even in peace-time, by strong Section 120 of the National Defense Act of 1916. Part of these, by virtue of President Roosevelt's recent declaration of a limited emergency, are his today. The rest await his invocation, at his discretion, during "war or the imminence of war." Price-fixing and extensive industrial controls are authorized by Section 120. It also empowers the President to commandeer industrial plants, place obligatory orders for munitions manufacture, and levy heavy penalties for non-compliance.

"But Section 120 is a pallid piece of business indeed," —the quotation is from FACTORY (May 1938)— compared to some of the legislation that has recently been proposed to implement the Industrial Mobilization Plan and to "take the profits out of war."

2,000 PAGES OF BILLS

On FACTORY's desk is a stack of proposed war laws, totaling over 2,000 printed pages, which have been introduced in Congress in the last two years. They differ in detail but tend to the same aims—first, to tax the living daylights out of industry, and second, to erect a towering structure of "super-agencies" to centralize government control of industry and commerce under an all-powerful "War Resources Administrator" reporting directly to the President. Excessive profits and inflation are recognized by the War Department as detriments to public morale and obstacles to the effective prosecution of war. Public opinion would probably support curbs of the most drastic sort.

Through his "superagencies," the wartime President would fix—and revise at any time—the prices of raw

materials and control their distribution to industrial users. He would license manufactures and determine priorities governing the transport of goods by rail, highway, water, and air. In the same way, he would regulate utilities, power, and fuel. A War Labor Administration would govern the supply of labor to industry. The existing departments of government would be supplanted by the "superagencies" and the President would be given freedom to create any additional boards and bureaus that he might deem necessary. Congress would be left with little to do.

The weakness of Section 120, in the last war, lay in the fact that while the government could threaten to seize factories, it lacked the personnel for their operation. The proposed Industrial Management Act would fill that gap. It calls for the registration of every man qualified by experience as a plant operating or maintenance executive.

THIS MEANS YOU

This means you, if you are so qualified. You would be "in the war" as surely as any soldier. You could be shunted from one job to another, from one part of the country to another. Your salary would be fixed by the President. If you attempted to obtain additional compensation from any source, you would be subject to a fine of $10,000, ten years in jail, or both. The President could make—or change at any time—the rules and regulations governing your conduct. Failure to comply would render you subject to discipline *by the military courts*. Thus, an industrial executive worth many thousands a year in peace-time could be drafted, commissioned, put into a uniform, and *sent back to his own job* at an army salary. And he would hardly be in a position to complain to regular army officers who have been serving all their active lives at army pay.

As for war profits, there are few loopholes in such tightly drawn measures as the Connally Bill providing individual net income taxes of 10 per cent, surtaxes ranging from six to 80 per cent, and corporate income taxes as high as 77 per cent. Another control-tightener is the Lee Bill for conscription of capital. It authorizes a census of the net wealth of all citizens, even before war begins. Individuals would then be compelled to lend to the government *on demand* a percentage of their assets (10 per cent on fortunes of $10,000 to $100,000) in return for *taxable bonds bearing one per cent interest.* These two bills are typical of the tenor of proposed legislation along this line. The price-fixing provisions of other measures would check the inflationary escape which confiscatory tax rates usually provide in themselves.

THE LAST ONE COST US $52,000,000,000

The recent enactment of stiff tax measures in Canada brings home to U. S. industry the realities of this situation. Can such things as the Connally and Lee bills pass? In the war psychology, *any* bill can pass. Would such appallingly heavy taxation be necessary? The World War is estimated to have set back our national economy some $52,000,000,000. The cost of another conflict is currently beyond computation. With the objectives of pre-war economic planning, no patriotic person can quarrel. If we go to war, industry will accept every necessary restriction, just as the individual will surrender much of his liberty in the interest of national survival. But no plan can insure us against the post-war economic collapse which would, in turn, render representative democracy doubly vulnerable to the designs of dictators. *The Industrial Mobilization Plan constitutes in itself an irresistibly forceful plea for peace.* And this review is presented by FACTORY in the belief that it is not too soon to consider the question fully. The laws that would make the plan a reality have not been passed. Possibly they never will be. But the Plan is there for all to see—and no action tending to involve us in war should be taken without a full realization of the possible consequences.

SUMMARY

In accordance with the promise of August, a marked upturn in business has been recorded for September. A war has intervened in the cycle without the depressing effect that war was expected to produce and perhaps without very much war business either. One leading observer has ventured the view that industry may be about to embark on a "new era," after 10 years of depression. The evidence of an upswing is unmistakable. A prolonged period of revival may be ours—*if we stay out of war.*

The editors believe management can make use of this article to inform employees concerning developments and trends of vital importance to industry and therefore to them. Reprints will be made available at nominal cost

FACTORY'S War Communiqués

NO. 1—MAY 1, 1938
INDUSTRY AND THE NEXT WAR

NO. 2—FEBRUARY 1, 1939
INDUSTRY AND THE NEW DEFENSE PROGRAM

NO. 3—SEPTEMBER 1, 1939
IF EUROPE GOES TO WAR

NO. 4—OCTOBER 1, 1939
AFTER FOUR WEEKS OF WAR

SEE ALSO IN THIS ISSUE
(page 58)
VESTIBULE SCHOOLS
PLANT SABOTAGE

BUSINESS
Stands Against War

Let us take a clear-eyed look at this thing we call War.

WAR is a political tool for domination or suppression; a device of futility—unless it be waged in defense of our homes, our property or our rights—in the preservation of our liberty. War destroys everything it touches. So completely does it disrupt the order and progress of civilization that humanity falters.

Dangerously widespread amongst our people today is the assumption that our participation in the European War is inevitable. Some mistrust the temper and program of the federal government as likely to lead us into it; others fear that our sympathies will make us an easy prey to the propagandists; still others suspect that business and industry, in a blind greed for profits, may involve us in the conflict.

To give credence to such beliefs is to deny that we are normal individuals, endowed with intelligence and a will, or the ability, as a people, to profit by our own experience. In all human experience, death only is inevitable.

To say that Industry and Business want war or will encourage, directly or indirectly, our participation in the present war, is a vicious and deliberate lie.

The millions of us who, since the World War twenty-five years ago, have devoted all our efforts and energies to creating and building and improving that which we know today as American Industry and Business, are convinced that the destiny of this country can be wrought only in peace. We cannot, and *must* not, stand aside and watch even the little progress we have made since that war sacrificed to the pestilence of another world conflict. We who are trying to build a lasting heritage for those who will follow us truly know that "there never was a good war or a bad peace".

Perhaps it is time to re-emphasize two of the three elements of our democratic faith, so simply stated by Abraham Lincoln, "that government of the people, by the people, for the people, shall not perish from the earth". Now, of all times, it will be wise to inform our political stewards that government by the people and for the people must be the guiding principle in what they do during the days to come, and that it is our *will* that in our country peace shall be preserved.

Only the grim and solitary courage of each of us, the determination to exert all our intelligence, all our individual influence in every way, can insure the preservation of peace for our country.

Preparedness we know to be the most effective preventive weapon against the threat of war. We must be certain, therefore, that we provide our air, land and sea forces with the best in armaments and material, in adequate supply to maintain properly and impressively our national responsibilities and defense.

Most important is that we as individuals, thus inspired, band together to exert the full strength of Industry and Business in the maintenance of peace.

If we are to succeed, we must be forceful, we must be articulate. To that purpose we pledge ourselves and the resources of our publications. An expression from our readers will greatly assist in such a mobilization of industrial opinion. Together, in this critical time, we can serve America well!

President, McGraw-Hill Publishing Company, Inc.

This message is appearing in all McGraw-Hill industrial and business publications, reaching over a million readers.

FACTORY
MANAGEMENT and MAINTENANCE
L. C. MORROW, Editor

Eyes Ahead, but Feet on the Ground

PLANTS ARE GETTING BUSIER. Never mind the cause, whether war or just business cycle. For the moment the point is that plants are getting busier. It is in order for them to look ahead to periods of intense activity such as they have not seen for a long time.

But it is during the process of getting busier that the men in charge of plant operation have to keep their feet on the ground. This period calls for more calm thinking and acting than does either a period of slow business or a period of sustained good business.

When there isn't much business, or when business is on the decline, men's thoughts turn to producing at low cost, to putting more quality into the product, to building up harmonious labor relations.

After business has remained good for a year or two, major efforts are again put forth in the same direction. The objective is consolidation of position in the competitive situation, and making hay while the sun shines.

But, during the process of getting busier, it is almost certain that the situation will be different. In the flush of the long-awaited experience, many things are likely to happen: Quality standards may be eased off. Labor rates may be set in too much of a hurry, with consequent serious errors. Standards in hiring may be lowered. Tactical mistakes are likely to be made in handling employees.

All these mistakes—errors of commission and omission—must be paid for some day. It seems permissible to be so bromidic as to say "An ounce of prevention is better than a pound of cure."

Cost carelessness rarely is excusable. To some extent higher costs are unavoidable during a period of increasing business, but real danger lies in the tendency, when orders come easily, to acquire a fine disregard for operating costs. When that happens, the ground lost must be made up when business is not so good.

Quality carelessness, too, tends to become an accepted attitude which eventually must be changed, in the interest of product reputation and customer confidence. With both quality and cost plant-operating executives can deal if they will take hold in time.

But particularly in the field of labor relations can plant-operating executives do a preventive job. Labor is at best touchy during a period of business increase, so that irritation has an abnormal effect.

A few simple, yet potent, non-irritating procedures can be followed: Take time in hiring; stick as closely as possible to carefully worked out methods of employee selection. Either take time to insure accuracy in setting new rates, or let employees know definitely that they are temporary or experimental. Do the necessary training of new employees, or old employees given new jobs, to insure their "making out" at the rates set. Maintain working conditions that cannot be used as a foundation for grievances.

These proposed procedures are intended to be suggestive, not inclusive. They will, we hope, stimulate plant-operating executives to work out their own programs for keeping their feet on the ground.

L. C. Morrow

The Industrial Town

Concluding the search begun last month for the characteristics that we feel will undoubtedly mark "The Industrial Town of Tomorrow." Some day there will be a town where all the human elements, vitalized by industry, are perfectly fused in friendly and cooperative understanding

CHARLES B. COATES

Assistant Editor

ALL OVER THE WORLD the wolves are howling for the neck of private enterprise. Public opinion makes and unmakes kings, generals, statesmen, and economic systems. With public opinion, to paraphrase Lincoln, industry cannot fail—nor without it succeed.

How can industry hope to hold the confidence of the people unless individual managements do a solid public relations job by demonstrating, daily and weekly and over a long period of years, their honest determination to make their plants better places in which to work and their towns better places in which to live?

FACTORY'S search for the specifications of tomorrow's industrial town, the town of perfectly balanced human relations, led me to a number of cities outstanding either for their freedom from strife or their success in overcoming dissension. And I found that industrial harmony is only one evidence of something much bigger called "the civic spirit." I found that when a town's industries are geared to its other human elements—governmental, commercial, charitable, and cultural—then that town will "click."

Shaping a City's Destiny

We know that strife, violence, and political corruption will discourage the expansion of industry within a town and repel new industries. We have seen in Dayton, for example, and Toledo, that good public relations, based on good labor relations in the plant and good citizenship in the town, can either shape a city's destiny for a favorable future or else snatch it from the jaws of an unkind fate.

What attracts *new* industries? Not long ago, a top industrial executive told me how he went about selecting a site for a big new plant. He was overwhelmed, of course, by the blandishments of chambers of commerce all over the country, some offering tax exemptions, free buildings as well as free land, liberal credit arrangements, and even working capital. Many tacitly boasted of "cheap labor."

"We're willing to pay our taxes," he said. "And I believe those financial lures are too likely to attract the doorstep babies of industry. I have noticed also that the 'cheap labor' towns are prone to strikes."

He narrowed the choice to two or three towns, visited them, and finally chose Blankville.

"When I went there," he explained, "I wasn't looking at a place but at people. I wanted to know who they were, where they came from, whether they were permanent or migratory. I looked at the tombstones in the churchyards and then at the city directory. I looked at the tax rate and bonded indebtedness to see if they were a thrifty people. I looked at the roads, the police and fire departments, to see if their government was clean and efficient.

"I wanted to see if they were a generous, friendly people, so I looked at the community chest. In the schools I found evidence of their intelligence, in the churches evidence that they cooperated well in mutual enterprises. I made sure there were not too many big, elaborate homes and too many slums; strong class differences cause unrest and ill-feeling. I also inquired about the other industrial managements to see if they were handling their own labor relations well and so building public confidence in industry. I talked to public officials, merchants, doctors, and lawyers to see whether they had a sense of civic leadership."

This man's company and Blankville are going to prosper together. They are beginning with a clear understanding of their mutual responsibilities. This, incidentally, is only one of many big firms that have chosen to expand in small communities. Industry is "on the move" as statistics show. One wonders how much of industry is "going small town."

Now to return to our inspection of individual cities. In Rochester we shall ask whether a long-established tradition of good industry-community relations can flourish under Eastern conditions as well as in the Middle West. In Cincinnati we shall examine some interesting experiments, and in Milwaukee we shall try to determine why a city, so long known for harmonious industrial relations, has fallen off the wagon with such a thud.

ROCHESTER

A Rochester manufacturer was about to increase his dividend rate two per cent. He talked it over with the other members of the Industrial Management Council of the Rochester Chamber of Commerce. Then he decided to boost wages and salaries first.

In perhaps no other city do industrial employers meet so frequently, cooperate so freely, and exchange views and information on progressive management policies so frankly. This is unusual as a chamber of commerce function, but the Rochester Chamber is the one that, many years ago, supported workmen's compensation when other groups were trying to mow it down. And Rochester is the town where management took the lead in unemployment insurance several years before the State got around to it. They say private enterprise did it better than the State, too, first in the

# of Tomorrow —PART TWO

Not precisely "The Industrial Town of Tomorrow," but an air view of Kodak Park, located in one of the "good" industrial towns of today. Seen from the nearby hills, Rochester looks more like a forest than a big manufacturing city. It is thus not only a good town to live in, but also, because of something inadequately described as "the Rochester spirit," a good town to work in

Gleason Works, then in Eastman Kodak, then in thirteen other plants.

Rochester is also the town that sailed through the depression without a bank failure, without scrip, bond defaults, payless paydays, or any of the fiscal agencies of stricken cities. In the administration of relief it has always been and is still one of the most just and humane of cities, although it has made but little use of WPA and federal aid.

Seen from the hills near town, Rochester looks more like a forest than an industrial city. Some of its landscaped factories resemble first-class high schools. ("Dirt and disorder," says a Chamber of Commerce booklet, "are regarded as evidence of poor management and inefficiency.") Rochester's steady, intelligent, well-paid wage earners, not all native-born by any means, are home owners (53 per cent, national average 48) and gardeners, wherefore the town is known as "The Flower City."

"Industrial peace," to quote the Chamber of Commerce again, "is a natural condition in Rochester," and this has been true in the largest plants since the days when Rochester's clothing industry finally found peace, after a lengthy struggle, in a Joint Board arbitration agreement with the Amalgamated Clothing Workers.

Not Born, but Made

In Rochester it is especially evident that conservative people are made not born. They are made by the policies of management. Rochester management considers industrial peace good business, has been willing to spend time and money on it. Here the 40-hour week was adopted early. Vacations with pay are practically standard.

Except for men's clothing, the major industries are not unionized, although in the building trades and service industries neither unionism nor strikes are unknown. (For example, CIO has chosen Rochester as the initial salient in its invasion of the AFL-dominated building trades. A merry battle may ensue here.) But mediation and restraint are Rochester traditions, and violence is deplored.

If first-rate wages and working conditions were the sole expression of the town's management attitude, however, Rochester wouldn't be the city it is. Here the civic spirit is such an actuality that it has been given both a name ("The Rochester Spirit") and formal recognition. Each year the Rochester Museum of Arts and Sciences awards a medal to "that person who has, without ostentation and with deep sincerity, contributed largely to civic life and improvement."

Most recent recipient is pleasant, plain-spoken, white-haired James E. Gleason, who heads the Gleason Works, a park-like shrine of good management where men in white shirts make cut gears and bevel-gear-cutting machinery. Not solely for his industrial achievements nor even for paying his workers well did Mr. Gleason get a medal, how-

ever, but for "quiet accomplishment, square policies, and principles throughout his entire life that have presented to the citizens of Rochester ideals of which industrial and civic circles are indeed proud."

Translated this means—and note the range of it—that Mr. Gleason is a trustee of the University of Rochester, a director of the Rochester Mechanics Institute and of the Bureau of Municipal Research, and a director and former president of the Community Chest. He stands high in the councils of the Chamber of Commerce and has been a ruling influence for industrial peace.

Some years ago I heard Harper Sibley, the Rochester banker who was then president of the United States Chamber of Commerce, make a speech. He told about a wealthy Rochester family who, during the depression, held a conference and voted to risk everything they had, from father's shirt to the baby's bank, in a gamble to save their business and their employees' jobs. Frankly I was skeptical at the time, but I believe it now. It's "the Rochester spirit."

How It Grew

Does anyone suppose this spirit is breathed from the air of the Genesee Valley or derived by the people of Rochester from some special item of diet? Let me tell you how the Rochester spirit grew.

When the late George Eastman was a young bank clerk, he was passed over for promotion—unjustly, he believed—in favor of somebody's cousin. He never forgot that. While turning us into a nation of camera fans, he built up one of the fairest, most comprehensive industrial relations systems in existence.

His huge personal benefactions, not only to the town but also to his employees, were only part of the story. Paternalism was not his aim, but he did perceive the importance of security in building employee morale, a principle firmly fixed in the philosophy of his successors. Under President Frank W. Lovejoy, Eastman Kodak has grown even greater, and its personnel policies have constantly improved. The company's 18,000 employees prosper today under a profit-sharing plan that has paid wage dividends in every year save one. They participate in extensive retirement, annuity, life insurance, disability, and medical service plans. Layoffs are handled with care, and the company has made great strides in stabilizing employment. There is no group relations system, but supervisory employees are expected to listen to and adjust complaints. Eastman himself never believed in having his office full of workers with grievances, so he chose and trained executives with care, held them responsible for keeping the peace.

Rochester management's tendency to get together and promote good policies dates back to Eastman's day. As the moving spirit in the Chamber of Commerce, he did much to shape the town's industrial destiny, actively discouraged the location of certain "low-wage" industries in Rochester because he considered them out of tune with the tenor of the town.

Upon Rochester's ownership families he enforced the principles of democracy in a manner that was downright autocratic. To his influence, undoubtedly, they owe much of that sense of stewardship and civic responsibility which they still display today. A natural aristocracy of ability and brains as well as breeding, they pride themselves on wearing their wealth well, look askance at the flashier millionaires of nearby cities. But this attitude had some very forceful encouragement in Mr. Eastman's time. It is a matter of record that when one wealthy Rochester family hired a footman to go with their chauffeur they received a sharp note from the Community Chest stating that their ability to contribute had evidently been underestimated.

Of such is the Rochester spirit. It hardly seems necessary to add that the town has a shipshape city-manager government,* that its securities are collectors' items eagerly fought for by investors at record low interest rates, that its two chief newspapers, both owned by Frank E. Gannett, compete keenly to keep the public well informed and are powerful forums for constructive civic discussion, unbiased in their treatment of news.

On one point or another it may be excelled by one city or another, but I will venture the assertion that no city over 100,000 can match Rochester (population 328,000) item for item on public and higher education, libraries, hospitals, civic and social agencies, parks and playgrounds, public health, and accident, fire, and crime prevention.

* An example of good government's contribution to a city's economic life is the City of Rochester's Department of Commerce, launched in 1938.

EDWARD F. McGRADY
Vice-President
Radio Corporation of America

CINCINNATI

Not so much for its history of labor peace as for its fame as the scene of one of good government's first big triumphs over bossism, did Cincinnati fall into the path of this inquiry. Cincinnati was my first port of call. By comparing it with some of the cities I have seen since, I have concluded that it can be summarized as a town where the civic spirit is neither fully asleep nor fully awake.

In nearly every town that has more than two factories, they will tell you that the industries are "broadly diversified." Cincinnati industry is genuinely so—spread out over such lines as machine tools, men's clothing, soap, printing and publishing, radios, refrigerators, meat packing, automotive and electrical equipment, and trailers. It has been largely free of the worst aspects of labor strife and so has kept politely out of the headlines. But it has strikes, quite a few, and it hasn't had its last one. It tends to be a "low-wage" town. it is fairly well unionized, but I was told that its strike record would be vastly worse were it not for industrial diversification and the relative stability of jobs, the soundness of the city government, which held up handsomely through the depression, competent handling of relief and unemployment, and the conservative temperament of the people, many of whom are of German descent.

Primarily, I sought to determine whether governmental reform had benefited Cincinnati industry. Management men say it has. Between 1920 and 1925, in the last days of boss rule, the population increased only 2 per cent. The municipal services were run down, costly, and corrupt, the streets were in

"The local community can do little to check labor disturbances that arise in connection with nation-wide strikes," Edward F. McGrady, Vice-President of the Radio Corporation of America, points out, "but many disputes, local in character, can easily affect other communities if allowed to spread."

Mr. McGrady, who as Assistant Secretary of Labor sponsored the successful Toledo Peace Plan, makes this statement to the readers of FACTORY on the importance of good community industrial relations:

"In many cases, managements, harassed by troubles, have moved factories from strife-torn communities to other cities and other states. For the same reason, plant expansions have often been postponed and even canceled, and hundreds, sometimes thousands, of workers have lost their jobs, with the result that they were thrown on the community for support. Such disputes, I firmly believe, are community problems, but often, due to lack of proper public spirit or to the absence of organized community cooperation, minor strikes have been allowed to develop into major tragedies."

Mr. McGrady proposes that community mediation work be undertaken in the same spirit in which cities now provide for fire-fighting forces.

"All too often," he says, "an obscure labor dispute arises in some corner of a city, and is allowed to continue and become worse simply because it is 'nobody's business' to try to settle it. Presently the unrest, impatience, and animosity generated in that one situation will grow like a conflagration and affect other industries in the city. If there were some authorized mediation agency to step in between the angry principals at the outset, this might be prevented."

disrepair, and the city fathers were borrowing to meet current expenses. Only 24 cents of the tax dollar went into city services while 21.5 cents went for debt. The general atmosphere was one of cynicism and stagnation.

One of the first fruits of the city manager reform was the construction of the handsome $40,000,000 Union Terminal which the railroads had been reluctant to undertake in view of the city's previous condition. The municipal debt mountain has since been melted to workable proportions. Only 16 cents of the 1939 tax dollar goes for debt service and 32 cents for city operations. The burden upon the taxpaying industries has been lightened, and the population (now over 480,000) has increased ten per cent.

An unusual Cincinnati feature is its Committee on Coordination and Cooperation. The members are City Manager C. O. Sherrill and the president of the Board of Education and the president of the Board of County Commissioners. Calvin Skinner, director of the Bureau of Governmental Research, is its secretary.

On the principle that they are working for the same set of taxpayers, the committeemen have compared notes, coordinated purchases, saved as much as $100,000 a year on a single item. The Committee also makes a broad attack on the unemployment question, has developed a unique four-point program for long- and short-term study of vocational needs to provide training to meet the present and future requirements for certain types of labor (thereby heading off some rather costly and unnecessary training projects), a census of the city's unemployables, and a "Make-A-Job" plan to fit a certain group of workers for use in two or three highly seasonal occupations which, taken together, may keep them busy the year around. The committee cooperates with all public offices and with such agencies as the Ohio Mechanics' Institute and the Cincinnati Regional Department of Economic Security.

The Facts of Labor

The Regional Department, under direction of Lorin A. Thompson, Jr., has, in collaboration with the Committee, made excellent use of $400,000 granted by the Spellman Fund. I doubt that you will find in any city so many *real facts* on the labor supply, the skills available, the amount and nature of unemployment, and vocational needs. A special study was made with a view to fitting the abilities of shoeworkers (left behind when the factories departed in a haze of labor trouble) to work in other industries. The "Make-A-Job" campaign grew out of the discovery that certain plants were still advertising out of town for help in seasonal rush periods while the local jobless remained on relief. A time-and-money-saving tabulating card system was installed in the local employment service, so that anyone who came in and asked for fifteen left-handed Swedish carpenters with red hair could get them in a jiffy.

As the laboratory of such experiments, Cincinnati may make contributions of national importance to the study and correction of basic economic problems. But the city seems to be awaiting the pressure of some strong, unifying force to make its own discoveries locally useful. The "Make-A-Job" campaign has been taken up by other cities, but it has yet to be applied in Cincinnati on a city-wide basis.

The fact is that industrial management does not appear to be uniformly allied with the various factors that bespeak the civic spirit in Cincinnati. For example, the impetus to reform in the city government came not so much from industry as from a few outstanding lawyers, newspapermen, and civic leaders downtown, such as Murray Seasongood and the late Henry Bentley. The charter group still has to fight periodically for good government's life. Heart and soul of the movement is personable, youthful Charles P. Taft, son of the late President William Howard Taft and brother of Senator Robert A. Taft. He is a successful lawyer, a Community Chest leader, and a moving spirit in the Regional Department of Economic Security.

In other words, good government in Cincinnati has the approval, but does not appear to get the *active* support, of industrial management, and so must struggle to survive by virtue of a delicate, almost weird, coalition of taxpayers and women's groups, the vigilance of a few key men, and the support of very strong newspapers.

Nor does Cincinnati boast a major management group dedicated to the furtherance of good employee relations. There are district differences in the policies of Cincinnati employers. A few, such as Procter and Gamble, Nash Tailoring, with its celebrated "Golden Rule" policy, and the Cincinnati Milling Machine Company, stand out, but these apparently are not big enough to influence the industrial community decisively. I was told before I went there that I would find in Cincinnati evidence of "a new rationality, an awakened management conscience." I did hear of one manufacturer whose friends kept after him, at clubs and

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Whenever a majority of any city's managements, or those employing a majority of the industrial wage earners, get together and *practice* a code of progressive public relations, they will achieve the same results we have seen in Middletown, Dayton, South Bend, and Rochester

committee meetings, until he agreed to abandon the practice of importing, for seasonal rush work, girls from nearby Kentucky who, cast loose from their jobs, became a problem for the police and social agencies. But that was about all I heard along that line.

It is significant, perhaps, that Cincinnati has had no one big dominant industrial employer to call the tune for the rest of the town, no John H. Patterson, no George Eastman in its background. Cincinnati is well below the national average in home ownership, a bit below in automobiles, although well above in radios, telephones, and electric meters. It has a high percentage of big incomes, a low average family income, a serious slum problem, and a high death rate.

MILWAUKEE

Milwaukee, a city of widely diversified capital goods industries, long famed for its excellent city government, its traffic safety, low crime rates, its good handling of relief and unemployment, and other traits of an orderly and conscientious community, boasted also, until quite recently, one of the most respectable strike records among cities of 500,000 population and above. Now it seems bent on working up a reputation for strikes. Its 1938 man-day loss of 215,607 was almost equal to the 1937 figure, while the nation's averages were two-thirds less; 1939 bids fair to be worse.

Nobody seems to know why. It's especially puzzling because Milwaukee went through the early phases of the depression with an excellent record on every front. The big traction strike of 1934 gave the first hint of the unrest which has now made itself manifest. I'm sure that if, before then, anyone had asked why Milwaukee was so peaceful, the reply would have been, "The people are Germanic in origin, and are quiet, home-owning folk. Jobs are steady because the industries are diversified."

Paradoxical Milwaukee

Well, the people are hardly less German than they were in 1933, and the industries are no less diversified. So we had better look for other reasons.

One Milwaukee paradox is the fact that its calm, conservative Germans have long been given to Socialism, which is sometimes considered a form of radicalism. While the Socialists have never had a majority, the people have gone on electing a Socialist mayor for so long that they have forgotten how to vote for anybody else. (Typical comment: "You may not like Hoan, but you have to admit he's honest.") Of course, Socialism is visionary; it tends to be a "hereafter" sort of philosophy. Perhaps it might be said that, after 50 years of the mild Socialist beer, Milwaukee labor has suddenly acquired a taste for the schnapps of industrial unionism. This trend is deeply disturbing to the staid citizens of Milwaukee. They forget, perhaps, that the effect of two drinks on a deacon can sometimes seem more alarming than the town drunk's second quart. For real riot and civil commotion, Milwaukee has a long way to go before it equals the antics of Detroit, Cleveland, Akron, and Seattle. However, the place *is* upset.

Milwaukee politics, Wisconsin politics, and labor relations are all mixed up together. I was told by employers that Milwaukee labor had fallen into the hands of radicals, and by labor leaders that the state government had fallen into the hands of reactionaries. (They passed a very severe labor restriction law there last year.)

The fact is that one senses there a sharp feeling that government must represent either management or labor, never both, and that the two must eternally be jockeying for control. They can get together on some things—Hoan, for example, who is not exactly a pure Marxist and has always been a good "business" mayor. But the cleavage goes back to the days of "Fighting Bob" La Follette at Madison, the perennial battles of his "half-breeds" against the "stalwarts," supporting the railroad and lumber interests, with the two factions tugging hard at the decisive vote of the middle classes.

Like Cincinnati, and unlike Rochester, Milwaukee's impulse to good government did not have its origin in strong industrial support. At the turn of the century, the city administration was about as corrupt as it well could be. Three young newspapermen wrote the stories that sent District Attorney Bill Bennett, a Dewey in his day, soaring to the Governor's chair, installed "Boy Mayor" Shirby Becker, and paved the way for Hoan and his Socialists, although the Mayor was destined to survive the power of his party by many years.

As seems to be the way with diversified-industry towns, Milwaukee also has had no one big industry or industrial personality to shape the city's destiny, nor does one find evidence of a concerted management movement, to improve industrial and public relations. The personnel policies of such firms as The Nunn-Bush Shoe Company and The A. O. Smith Corporation are outstanding, but the majority are not especially distinguished.

"Perhaps it's as simple as this," said one plant manager, when I asked him to explain why industrial relations in Milwaukee, peaceful even in the days of labor's political power, had suddenly grown so tense. "Most of these Milwaukee firms were founded and built up by individuals. They had, like so many of their employees, the German love of fair play. Though not especially generous, they were just. They *knew* their men on a John-and-Bill basis—or rather a Herman-and-Otto basis—and the men knew them. There was never any trouble that they couldn't talk over and settle together. Now these firms are passing into the second and third generations of ownership, they have grown much bigger, many of them have passed out of local control, and in other cases the gap between men and management has grown because neither is quite the same type."

That could be it, of course. You might go on from this to say that the majority of Milwaukee employers have evolved no formal substitute for the earlier good relationship. *Some* important change is afoot, anyway. There is certainly plenty of unrest and dissension working in the mass of this well-run, civically excellent body politic.

Looking for the Combination

I was told that Milwaukee has something of a "low-wage" background, and this may be so. Home ownership is a bit below par, although income distribution doesn't seem to be radically disproportionate, unemployment is no worse and is better handled than in most cities, and in the possession of automobiles, radios, telephones, and electric meters, the town is above average all along the line. It may be that some organized anti-union activity has helped to stir things up. It may even be that Milwaukee labor has suddenly gone communist, as some employers contend. It may be, as others say, that such militant organizers as Meyer Adelman, of Fansteel strike fame, whom CIO sent into Milwaukee, have gotten employers' backs up. It may be a combination of all these things.

You hear so much conflicting evidence. Mayor Hoan is praised and blamed for the police department policy of leaning over backward to give labor a break . . . Gov. Julius P. Heil, leader of the currently triumphant conservative political forces, is considered pro-labor by many employers . . . Labor is plenty mad at the powerful *Milwaukee Journal*, but the employers aren't crazy about it

either. It is not, as it once was, a whole-hog, liberal labor paper. Nowadays it criticizes labor editorially. But it still seems impartial in its treatment of news . . . One employer tells me labor is so touchy that managements go to fantastic lengths to avoid trouble . . . Another one says: "Any employer who cannot get along with Milwaukee labor, won't get along with labor anywhere."

You have paid your money and the choice is yours. I'll admit I haven't told you why Milwaukee has gone in for strikes. The fact is, I don't know.

* * *

That makes nine towns we've studied. Let's add up some of the conclusions that our findings in a majority of cases entitle us to draw.

The things that go into the making of a "good" town are many. Good government, good social agencies, good handling of unemployment and relief, equitable distribution of income and worldly goods, diversification of industry, local ownership of industry, cooperative machinery for settlement of disputes—all these are frequent but not absolute characteristics of "good" towns. All civic activities are at their best and most effective when management participation is involved. One city may be deficient in some of these respects but especially strong in others, and so may get the effect that another city achieves through balance. It is hard to evaluate these factors comparatively just as it is hard to say whether a football team's success is due more to a strong line, a star ball carrier, or a good coach.

Wet Feet

But we did find one feature fundamental in all "good" towns, conspicuous in the "best." That is the acceptance by major industrial employers of a very broad concept of their responsibilities—toward their own employees, toward the community. We have seen it demonstrated again and again. No other single explanation, such as the diversification idea or the Germanic or native-born population theory, will suffice. People are made conservative by the knowledge that the biggest and most influential employers, the nearest visible symbols of private enterprise, are working sincerely and vigorously for the well-being of the community. Not paternalistically, mind you, not superficially—if you merely dip your toes in public relations, you will only get your feet wet—but cooperatively.

The expression of good public relations takes these forms: First, good wages and good working conditions in the plant; then, in the town, active and vigorous attention to clean, efficient, economical, democratic government, public health, housing, education, social agencies, vocational training, security, and the relief of unemployment and distress—to everything, in fact, that removes fear and puts hope into the lives of men; and, finally, when the program checks at every other point, an honest effort to place the facts about industry before the public through the medium of news, none withheld.

Here are some typical word-of-mouth comments that bespeak the reaction of the public to management policies:

"Consolidated is spending a lot of money to keep jobs steady . . . They pay good wages, and everybody from the big boss on down is fair and square . . . Sure, I know Mr. Big, he made a speech at the community chest rally last night . . . Pat was laid off for keeps, but they gave him something to go on . . . A lot of good men left Amalgamated and went to work for Consolidated. Then Amalgamated got wise to itself . . . You know who stopped that strike? Mr. Big and a couple of other fellows got Mr. Balky into a corner, down at the City Club, and talked some sense into him . . . The Council wanted to cut the hospital fund, but Big wouldn't stand for it. . ."

I Know Because—

Or—"The minute times get slack, Amalgamated turns 'em out like cattle. I know because they trade at my store and I have to carry them . . . How you going to sell vacuum cleaners to people that make sixteen bucks a week? . . . A great many of my parishioners (or patients, or customers) are among their employees and I know what conditions are there—the men have every right to strike . . . Balky makes a speech in the papers about what a fine thing industry is—he should keep his mouth shut. Big, now, he *does* things . . . dump all their people on relief . . . us taxpayers have to pay for it . . . there ought to be a law. . ."

When one of these attitudes or the other prevails long enough, we shall know whether American industry is destined to thrive under democratic capitalism or fall under the dominion of a pack of porky politicians as it has in some European countries we could name.

Local ownership of industry, by the way, is a point that has probably not been sufficiently stressed. Or perhaps I should say local *management*. If Mr. Big doesn't own control of his company, he has to be strong enough to sell his policies to his stockholders. Some big national companies now vest full power of public relations in local Mr. Bigs. Mr. Balky's hands are often tied. Lately there has been a tendency to "decentralize" management away from finance. Let's hope it continues. Mr. Big is at his best with one foot in the plant and one in the town, and he has no business being any place else.

Now I am going to spotlight the outstanding weakness of my thesis before somebody else does it for me. The fact is that I have found the proof of my contentions *only* in towns no larger than 300,000 population or thereabouts. This announcement will be greeted with cheers by those who contend that big cities are just so blooming big they won't respond to good public relations.

Why not? Has it ever been tried? Why can't Milwaukee, for example, take a page from Toledo's book? Of course, the Toledo Peace Plan is no panacea. Management men and labor leaders both say it will work only when you can get an Ed Ruffin to make it work. But mediation (using the pressure of public opinion to enforce rationality on both sides) is the first step in restoring industrial peace and coaxing the civic spirit back to its perch. I don't know just what's going on in San Francisco, but by some cooperative hook or crook they averted 50 threatened strikes in the first 60 days of the new Employer's Council. Newark is doing the same sort of job.

At any rate I'll make you this bet—that whenever the majority of *any* city's managements, or those employing a majority of the industrial wage earners, can get together and *practice* a code of progressive public relations, they will achieve the same results that we have seen in Middletown, Dayton, South Bend, and Rochester.

The Dynamic Human Factor

It has been a pleasure to report the existence of so many cities where managements have long appreciated or dramatically discovered the tremendous importance of the great, dynamic, still largely unknown human factor in industry. But there has been nothing in these pages, I fear, for those who advocate some special economic or political creed. From their point of view, our "best" towns are probably little better than the worst. But if you agree that it is more constructive to compare one actuality with another actuality and not with an ideal, then perhaps we've got something.

There will be a town, some day, where all the human elements, vitalized by industry, the mainspring of a city's economic life, will be fused *perfectly* in friendly and cooperative understanding. *And that will be the industrial town of tomorrow.*

Conveyor Paid Out in 2 Years

Five gravity conveyor feeder lines lead from the six packing lines. Each has a belt booster which raises cartons several feet so that they can again be handled by gravity

Labor savings alone were enough to return first cost of 750-ft. conveyor the first two years. And there are a good many other benefits

JAMES COLLIER

Works Manager
S. C. Johnson & Son, Incorporated
Racine, Wis.

SIMPLEST APPROACH TO THE WAY in which our carton conveyor operates is to consider how we used to do it. We have six packing lines which terminate in top-and-bottom gluers. We used to keep four men in this department, at the ends of the packing lines, taking the packages off and placing them on skids. Four electric lift trucks hauled the skids away to the stockroom warehouse or direct to the cars in which they were to be shipped, depending on

Feeder lines meet the conveyor at this transfer station where a girl now controls movement of cartons to stock or to freight car

whether the lines were at the moment producing the goods required for immediate shipment. This meant eight men on loading and hauling skids.

Because of current production, there is a premium on space. We were forced to leave only enough aisle to permit passage of one electric truck. This, in turn, meant that we frequently had one truck dodging out of the way to let the next truck pass.

Handling incoming material was done with hand trucks, usually with six to eight men on the job. It was none too efficient, and we knew it, but there seemed to be space for just about four electric lift trucks in the working space, and the hand trucks were the obvious alternative.

This has all been changed. In briefest possible terms, we put the handling of packed cartons on a conveyor. We still use about half the time of one electric lift truck for a job receiving, and retired the hand trucks for all except a few small-bulk odd jobs they seem to fit. The conveyor automatically takes the packages from the ends of the packing lines, so we were able to transfer those four workers to other duties. We put a girl on a transfer station where her principal job is to punch switch buttons, and put an average of two and a half men's time into the stockrooms to handle cartons.

All told, we now get along com-

(Continued on page 134)

Trunk line travels overhead the entire length of the stockroom, has take-off stations every few feet. At far end, it leads to a chute which runs direct to loading platform

On the loading platform, at the end of the trunk line, portable gravity conveyor sections deliver the goods right into the cars

Budgeting to Cut Unit Costs

A second practical and timely article out of Talon's experience with coordinated budgeting. In this one the authors outline step by step how their concern sets up production budgets that are designed to cut unit costs

P. K. POULTON and P. H. GOLDSMITH

Secretary & Treasurer and Budget Director
Talon, Incorporated, Meadville, Pa.

BUDGETARY CONTROL is the most effective instrument that management can use to transfer plans and objectives into action. For this reason, everyone from the president down to the last supervisor must know what objectives he will be expected to attain and just how his individual part fits into the complete plan. Only the full realization of this principle will insure the complete coordination of the budget program.

The Big Objective

Reduction of the average unit cost is an objective we all are striving for, and one that clearly illustrates how management can maintain satisfactory profit margins through the use of a coordinated budget. In order to bring about the desired reduction in unit cost, the following fundamentals should be given attention:

1. Every individual in the organization must know from the start what share of the cost reduction he will be expected to bear and specifically where these savings are to be effected.

2. He must know how his expense budget is to be allocated and must agree that his allowable expense is reasonably sufficient to operate his division, department, or unit at the budgeted volume of production. (This usually requires some salesmanship on the part of the management. Nevertheless, the support of the entire organization must be won before the budget is adopted; otherwise the seeds of dissatisfaction will be sown and the whole program may be jeopardized.)

The responsibility for all expenditures must be assigned on a functional basis exactly parallel to the established lines of authority in the organization, and the budget forms should be designed to emphasize this relationship.

4. By having each division and department head assist in constructing his own budget, each member of the supervisory staff will have a clearer understanding of the importance of his job.

5. Each department head should have a cost-volume schedule which will serve as a daily budget guide. With this schedule the foreman need not wait until the end of the month to check his

DEPARTMENT 10-61 - 1939 BUDGET

	Line No.	ANNUAL BUDGET	JANUARY Mo.	FEBRUARY Mo.	FEBRUARY Acc.
40 Piece Work	1				
41 Day Work	2				
42 Job Order	3				
	4				
TOTAL DIRECT LABOR	5	15,000	1,250	1,200	2,450
	6				
50 Supervision	7	3,000	250	230	480
51 Clerical	8	100	8	5	13
52 Set Up	9				
53 Maintenance	10				
55 Misc. Indirect	11	100	8	5	13
56 Overtime	12	100	8	5	13
57 Third Shift Differential	13	300	25	15	40
58 Retainer	14	100	8	5	13
59 Vacation Time	15	300			
60 Machine Down Time	16				
63 Call Time	17				
65 Wait for Work	18				
69 Special Departmental	19				
	20				
TOTAL INDIRECT LABOR	21	4,000	307	265	572
	22				
70 Tool & Die Parts	23	300	17	15	32
71 Supplies	24	200	17	15	32
75 Printing & Stationery	25	200	17	15	32
76 Travel and Entertainment	26	50	4	5	9
91 Repairs & Maintenance Mat'l	27	300	30	20	50
92 Small Tools	28	50	5	5	10
95 Payroll Taxes	29	1,000	80	75	155
98 Misc. Expense	30				
	31				
TOTAL SUPPLIES & EXPENSE	32	2,000	170	150	320
	33				
TOTAL CONTROLLABLE OVERHEAD	34	6,000	477	415	892
	35				
PRO-RATES:	36				
Management	37	5,000	400	350	750
Tool Rooms	38				
Maintenance and Electrical	39	3,000	250	200	450
Machine and Tool Repair	40	2,000	160	130	290
	41				
TOTAL FACTORY OVERHEAD	42	16,000	1,287	1,095	2,382
	43				
DIRECT MATERIAL	44	219,000	17,963	17,205	35,168
	45				
GRAND TOTAL EXPENDITURE	46	250,000	20,500	19,500	40,000
	47				
UNIT COST PER TAPE FOOT	48	.09370	.09370	.09380	.09380
UNIT COST PER EQ. FASTENER	49	.26720	.26700	.26700	.26700
	50				
PRODUCTION - TAPE FEET	51	2,640,000	222,000	212,850	434,850
DIRECT LABOR HOURS	52	22,415	1,892	1,812	3,704
OPERATING DAYS	53	282.0	23.8	22.8	46.6
PRODUCTION PER OPR. DAY	54	93,617	93,617	93,617	93,617
D. L. HOURS PER OPR. DAY	55	79	79	79	79
PERCENTAGE OF CAPACITY	56	63	63	63	63
AVERAGE HOURLY EARNINGS	57	.62	.62	.62	.62
	58				
	59				
	60				

Budget Department RLR:CHP

Figure 1. A typical annual departmental budget for a direct production department. All of the figures in this and other budgets shown in this article are hypothetical

performance with the budget. When he receives his production orders at the beginning of his shift, a glance at his schedule will tell him the maximum cost at which he can produce the required number of units without exceeding the budget limit.

All departmental budgets should use one common cost denominator so that each budget will tie in with the total manufacturing cost budget. The total manufacturing cost will then equal the sum total of all division budgets, which, in turn, will equal the total departmental budgets included in each division.

This systematic approach to budgetary control along functional lines is a valuable asset in developing teamwork through the organization. It also stresses the importance of the ultimate goal over and above the mass of figures and statistical data. Finally, it sets the budget program off to a flying start by winning cooperation at the most crucial time.

Setting the Base Line—A foreman cannot be expected to produce at maximum efficiency if he is not given a target at which to aim. In the final analysis his operating record must be compared with his predetermined goal. If he hits or exceeds his mark, he will have the satisfaction of knowing that he has done his part in realizing the profit goal set by his company, and that he is entitled to special consideration. If, during the course of the year, he finds that he is falling short of his goal, both he and the management can locate the expense items that are causing the trouble. This is an excellent example of the fairness with which a good budget system can be administered. A man who is doing good work can be given full credit, and the man who is falling down on the job receives ample warning of the impending disaster and assistance in the correction of the condition.

A typical annual budget for a direct production department is shown in Figure 1. This budget serves as a guide for the department heads and superintendent in formulating their plans and operating procedures throughout the year. In this way a base line is set for each direct department in the organization.

The first column on the left lists all the accounts that can be used in charging direct expenditures against the department. This column also shows the service expenditures of other departments chargeable against this department, the total departmental expenditure, the average unit cost of the department, the estimated volume of production, and the plant activity data.

The second column shows the annual budget for each account and items listed at the anticipated volume of production. Succeeding columns show the spread of the annual budget by months, with the year-to-date total. It is important that the year-to-date total be included, as there are many accounts in which expenditures may fluctuate so widely from month to month that the year-to-date picture proves a more desirable and satisfactory control.

PLANT 61 - EXPENDITURE AND UNIT COST - 1939 BUDGET

DEPARTMENT	Line No.	ANNUAL BUDGET	JANUARY Mo.	FEBRUARY Mo.	FEBRUARY Acc.
	1				
10-61	2	250,000	20,500	19,500	40,000
	3				
11-61	4	80,000	6,500	5,800	12,300
	5				
12-61	6	40,000	3,300	3,000	6,300
	7				
13-61	8	15,000	1,300	1,000	2,300
	9				
14-61	10	18,000	1,500	1,200	2,700
	11				
15-61	12	85,000	7,000	6,500	13,500
	13				
16-61	14	7,000	580	530	1,110
	15				
17-61	16	105,000	8,800	7,500	16,300
	17				
TOTAL DIRECT DEPARTMENTS	18	600,000	49,480	45,030	94,510
	19				
	20				
	21				
	22				
	23				
	24				
	25				
	26				
	27				
AVERAGE UNIT COST	28				
	29				
10-61	30	.26720	.26700	.26700	.26700
	31				
11-61	32	.11560	.11440	.11460	.11460
	33				
12-61	34	.05840	.05740	.05760	.05760
	35				
13-61	36	.01900	.01880	.01880	.01880
	37				
14-61	38	.02400	.02380	.02380	.02380
	39				
15-61	40	.13020	.12860	.12880	.12880
	41				
16-61	42	.30400	.29920	.29960	.29940
	43				
17-61	44	.00520	.00520	.00520	.00520
	45				
AVERAGE UNIT COST - TYPE 1	46	.69960	.69400	.69480	.69440
	47				
AVERAGE UNIT COST - TYPE 2	48	1.11720	1.10860	1.10760	1.10800
	49				
	50				
AVERAGE PLANT #61 UNIT COST	51	.71080	.70520	.70600	.70560
	52				
	53				
	54				
	55				
	56				
	57				
	58				
	59				
	60				

Budget Department RLR:CHP

Figure 2. Invaluable to the plant superintendent is this information concerning total plant expenditures and average unit costs, both of which are summarized by departments

Straight-Line Production

The amount of the annual total budgeted in any month is determined by the average mix of the product made, the volume anticipated, and the number of factory working days. It will be noted in the illustration that production has been scheduled on a straight-line basis, or at a constant volume per operating day. In our own plant the development of a straight-line volume of production has brought about a substantial reduction of unit cost. Changes in budgeted volume are made only when absolutely necessary, and no more frequently than on a quarterly basis.

In view of the fact that all expenditures in the factory are ultimately applied to the product as it passes through the direct production department, budgets for those departments will show the total manufacturing expenditure. In many budget systems only the factory overhead expenditures are included in the production department budget on the premise that these are the only costs over which the foreman has control. The fallacy in this line of reasoning is revealed when we consider the reasons for

PLANT #61 - EXPENDITURE BY ACCOUNT

	Line No.	ANNUAL BUDGET	JANUARY Mo.	FEBRUARY Mo.	FEBRUARY Acc.
40 Piece Work	1				
41 Day Work	2	190,000	15,700	14,500	30,200
42 Job Order	3	10,000	850	780	1,630
	4				
TOTAL DIRECT LABOR	5	200,000	16,550	15,280	31,830
	6				
50 Supervision	7	21,000	1,750	1,600	3,350
51 Clerical	8	1,500	125	115	240
52 Set Up	9	500	45	40	85
53 Maintenance	10	500	45	40	85
55 Misc. Indirect	11	2,000	165	150	315
56 Overtime	12	1,000	85	70	155
57 Third Shift Differential	13	3,000	250	230	480
58 Retainer	14	5,000	450	425	875
59 Vacation Time	15	5,000	450	425	875
60 Machine Down Time	16	400	35	30	65
63 Call Time	17	50	4	2	6
65 Wait for Work	18	50	4	3	7
69 Special Departmental	19				
	20				
TOTAL INDIRECT LABOR	21	50,000	3,408	3,130	6,538
	22				
70 Tool & Die Parts Replacement	23	6,500	540	525	1,065
71 Supplies	24	6,000	500	490	990
75 Printing & Stationery	25	500	45	40	85
76 Travel & Entertainment	26	100	8	7	15
91 Repairs	27	2,500	200	190	390
92 Small Tools	28	400	35	30	65
95 Payroll Taxes	29	9,000	750	700	1,450
98 Miscellaneous Expense	30				
	31				
TOTAL SUPPLIES & EXPENSE	32	25,000	2,078	1,982	4,060
	33				
TOTAL CONTROLLABLE OVERHEAD	34	75,000	5,486	5,112	10,598
	35				
Pro-Rates from Other Divisions:	36	100,000	8,300	7,800	16,100
	37				
TOTAL FACTORY OVERHEAD	38	175,000	13,786	12,912	26,698
	39				
DIRECT MATERIAL	40	225,000	18,500	17,000	35,500
	41				
GRAND TOTAL EXPENDITURE	42	600,000	48,836	45,192	94,028
	43				
	44				
	45				
	46				
PRODUCTION - EQ. FASTENERS	47	925,000	78,067	74,788	152,855
DIRECT LABOR HOURS	48	258,610	21,825	20,907	42,732
OPERATING DAYS	49	282.0	23.8	22.8	46.6
PRODUCTION PER OPR. DAY	50	32,800	32,800	32,800	32,800
D. L. HOURS PER OPR. DAY	51	917	917	917	917
PERCENTAGE OF CAPACITY	52	60	60	60	60
AVERAGE HOURLY EARNINGS	53	.72	.72	.72	.72
	54				
	55				
	56				
	57				
	58				
	59				
	60				

Budget Dept. RLR:CHP

Figure 3. Here total plant expenditures are summarized by account and budgeted for the coming year. Easy to figure how these data help the superintendent steer his course

including all cost elements in the production department budget:

1. The department head has some measure of control over all expenditures applied to the product in his department, but full control over none. Many overhead expenditures, such as overtime, result primarily from customer-service policies originated by the sales or other departments. The amount of supervision and clerical cost, furthermore, is usually established by superior officers. On the other hand, the average foreman has little more control over direct labor and direct material costs than he does over overhead items.

2. To be consistent in upholding the policy of making a better manager out of the foreman, it is desirable to make him conscious not only of overhead, but also of all costs absorbed by the product as it passes through his department. Even though he has little, if any, direct control over a cost element, he is in position to report adverse trends to his superior who can then take the necessary corrective steps.

3. The inclusion of all cost elements in the production department budget makes it possible to construct average unit cost controls that will show the foreman what his share of the over-all unit manufacturing costs will be.

Fitting Budget to Organization—The coordination of activities is one of the most important elements in a successful budget set-up. This end can be achieved only by budgeting expenditures in strict accordance with the existing organization for which it is made. It is imperative, therefore, to have all departmental budgets summarized under the plant and subdivision to which each belongs. In this manner responsibility is definitely allocated for every expenditure, and no alibi or excuse is left open for passing the blame on to the "other fellow."

Under this plan the plant superintendent receives the following data:

1. Plant expenditure summarized by departments (Figure 2).

2. Average unit cost summarized by departments (Figure 2).

3. Plant expenditure summarized by accounts (Figure 3).

Carrying the complete budget program one step farther, the factory manager is presented with budgets that summarize his total expenditures by department and plant, and also a summary of the same expenditures broken down by account number and average unit cost. The total expenditure budget is also broken down into budgets for direct labor, direct materials, and factory overhead. This gives the factory manager the whole picture of all the elements that make up his costs.

To the Exact Dollar

The tie-in of all budgets, which eventually leads to the master profit and loss budget, is shown in the sample budget illustrated. For example, the total budgeted expenditure of $250,000 for Department 6 (Figure 1, line 46) is indicated on the plant superintendent's budget (Figure 2, line 2), and also on the factory manager's budget. In a similar manner both the total expenditure and the unit cost for all departments are included to the exact dollar in the plant superintendent's budget, and again to the exact dollar in the factory manager's budget.

Flexibility in Cost Control—In order to have every member of the organization cost-conscious, each department head must know his cost elements from *A* to *Z*. It is not enough to provide him with historical records of previous costs; he should have the benefit of advance information to assist him in determining future expenditures at any given level of output.

The budget provides this information in the base-line picture of the annual operations anticipated in each department at the estimated level of production. While actual production and the estimated volume used in the budgets

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Plant 61
Department Sewing
Number 10
Foreman John Jones

1939 BUDGET

DEPARTMENTAL COST-VOLUME SCHEDULE

(Allowances per operating day at varying levels of activity)

ACTIVITY INDEX		10		20		PERCENT CAPACITY 30		40		50		60	
Production in Tape Feet		1,470		2,940		4,450		5,940		7,450		8,910	
Prod. in Equiv. Fasteners		520		1,040		1,560		2,080		2,550		3,100	
BASE - Actual Direct Labor Hours		12.5		25.5		37.5		50.5		63.0		75.5	
ACCOUNT		MAN HOURS	$	MAN HOURS	$	MAN HOURS	$	MAN HOURS	$	MAN HOURS	$	MAN HOURS	$
DIRECT LABOR	40 Piece Work 41 Day Work 42 Job Order												
TOTAL DIRECT LABOR		12.5	7.80	25.5	15.60	37.5	23.45	50.5	31.30	63.0	39.10	75.5	46.8
INDIRECT LABOR	50 Supervision	10	9.60	10	9.60	10	9.60	10	9.60	10	9.60	10	9.6
	51 Clerical	1	.50	1	.50	1	.50	1	.50	1	.50	1	.5
	52 Set-up												
	53 Maintenance												
	54 Repairs - Machines												
	55 Miscellaneous Indirect		.40		.40		.40		.40		.40		.4
	56 Overtime										.10		.
	57 Third Shift Diff.						.20		.50		.75		1.
	58 Retainer		.20		.20		.20		.20		.20		.
	60 Machine Down Time												
	61 Trav. & Quality Insp.												
	63 Call Time												
	64 Repairs - Tools & Dies												
	65 Wait for Work												
	69 Special Departmental												
TOTAL INDIRECT LABOR			10.70		10.70		10.90		11.20		11.55		11.8
INDIRECT SUPPLIES and EXPENSE	70 Tool & Die Parts Repl.		.10		.20		.30		.40		.50		.6
	71 Supplies		.15		.25		.40		.50		.65		.7
	75 Printing & Stationery		.05		.10		.20		.25		.30		.3
	76 Travel Expense		.05		.05		.05		.05		.05		.0
	91 Repair & Mtnc. Material		.10		.15		.20		.25		.30		.4
	92 Small Tools		.04		.06		.09		.11		.14		.1
	95 Payroll Taxes		.40		.80		1.15		1.60		1.90		2.3
	98 Miscellaneous Expense												
TOTAL INDIRECT SUPPLIES & EXP.			.89		1.61		2.39		3.16		3.84		4.6
TOTAL CONTROLLABLE OVERHEAD			11.59		12.31		13.29		14.36		15.39		16.5
GENERAL OVERHEAD PRORATES	Maintenance & Elect.		5.90		5.90		5.90		5.90		5.90		5.9
	Tool Rooms												
	Management		14.25		14.25		14.25		14.25		14.25		14.2
	Machine & Tool Repair		5.10		5.10		5.10		5.10		5.10		5.1
TOTAL DEPARTMENTAL OVERHEAD			36.84		37.56		38.54		39.61		40.64		41
DIRECT MATERIAL			124.50		248.40		373.50		498.50		622.20		746.8
GRAND TOTAL EXPENDITURE			169.14		301.56		435.49		569.41		701.94		835.4
UNIT COST PER TAPE FOOT			.11510		.10260		.09790		.09590		.09420		.093
UNIT COST PER EQUIV. FASTENER			.32530		.29000		.27920		.27380		.27530		.2695

Budget Department January 2, 1939 RLR:CHP

Figure 4. Guide to the foreman is this Cost-Volume Schedule which shows what expenditures should be at various levels of output

should approximate each other over a period of time, the output from week to week may fluctuate considerably from the budgeted level. For this reason the foreman must have a guide that will show him what his expenditures should be at different levels of output. This cost-control instrument is known as the "Cost-Volume Schedule" (or flexible budget) and is illustrated in Figure 4.

The upper section of the Cost-Volume Schedule consists of an activity index showing the output of the department in terms of unit and direct labor hours for various percentages of departmental capacity. The maximum output of three full shifts per operating day is taken as the equivalent of 100 per cent capacity. At each capacity level the expenditure allowance is indicated for every account used by the department. The chart of accounts in the left-hand column is the same as those used in the budgets for the department. In every case the expenditures are summarized and the corresponding unit cost is shown, as well as the man-hours corresponding to the costs indicated in the labor account. The Cost-Volume Schedule is not necessarily limited to any particular time period in expressing the cost and activity units, but for convenience and accuracy the operating day (24-hour working day) offers a number of advantages.

At the budgeted output the data expressed by the Cost-Volume Schedule multiplied by the number of operating days is equivalent to the corresponding budget for the period concerned. Should the department be required to work at any capacity other than that anticipated by the budget, the department head will have his guide and can control his expenditures and unit costs accordingly.

Establishing Unit Cost Control—Effective coordination of the activities of all departments in achieving a common

goal is best brought about by using a common cost denominator exclusively for all divisions and departments in the organization. Where the variety of sizes or types of product makes it impractical to use the average unit cost as the controlling element, it is often possible to find some other common factor, such as cost per standard hour of labor. One of the most effective methods of emphasizing the importance of each department to the company as a whole is to indicate on each production departmental budget its specific share in the average unit cost of manufacturing. No matter how production or product mix may fluctuate, the unit cost over a period of time should be equal to or less than the department's share of the total.

The Preliminary Budget—In the construction of a completely coordinated budget the first step is to establish guiding limits for all elements of expenditure and unit costs. These guiding limits will be determined by the following factors:

1. Estimated sales income for the budget period. This factor will be subject to the management's adoption of a definite price policy for the coming year.

2. Inventory turnover consistent with sound financial and service policies.

3. Minimum profit desired, as well as the maximum that is reasonably attainable. Determination of this figure depends largely upon the competitive position of the company in its industry, the profit prospects of the product being sold, the profit record in the past, and general business conditions.

4. Historical cost data and probable future trends of all cost elements.

With the above factors definitely known, the cost limits for the preliminary budgets can be set up as a guide in the construction of the final budgets.

After the over-all limit is determined for the total manufacturing expenditure, the preliminary breakdown into departmental expenditure is made by establishing the cost of direct labor, direct materials, and factory overhead. This can best be accomplished by analyzing past cost trends and anticipating changes in costs during the coming year. It is necessary, of course, to consider changes in labor rates and material prices, probable cost reductions through the introduction of new methods and equipment, and all other factors relating to the manufacturing expenditures.

These analyses are most effectively made on a unit cost basis, and are expedited by keeping comprehensive records of all pertinent cost and price data in chart form so that they may be compared to all related factors readily. This practice also helps to visualize the general trend in the elements being considered.

After building up preliminary data by individual cost elements, the total may be found to exceed the predetermined total unit cost. It is then necessary to determine what department and cost elements have been set too liberally. Steps can then be taken to make the reductions necessary to have all budgets tie in with the desired total manufacturing expenditure.

Winning Support for Budget—Following the establishment of the expenditure limits for the preliminary budget, the detailed sales forecast by products is converted into a production schedule, and the work of constructing the final draft of the budget by departments and accounts is ready to begin.

It is at this stage in the preparation of the annual budget when each member of the supervisory staff should be called upon to furnish active assistance in establishing budgets for which he will be responsible during the coming year. These men will be able to inject into the budget the experience and practical knowledge necessary to insure its success. The foremen and other supervisors can also furnish valuable information on possible cost reductions, and are frequently able to check cost estimates against their own figure obtained from other sources. The foreman, moreover, is definitely in a better

(*Continued on page* 122)

BUDGET DATA SHEET

DEPARTMENT 10-61 — ACCOUNT NO. 71-10-61

OPERATION NO. _____ — PRIORITY NO. 1

BURDEN CENTER OPERATION OR MATERIAL Supplies — DATE EFFECTIVE Jan. 1, 1939

TIME PERIOD covered by value given: Operating Day

100% CAPACITY: 14,800 T.F.

VARIATION WITH ACTIVITY: Direct

EQUATION: $C = \$.85 \left(\frac{T.F.}{10,000}\right)$

CODE
N - Fasteners — E - Employees
I - Net Chain Inches — T.F. Tape Feet
H - Labor Hours (Direct or _____)
C - Cost

DEPTL. CAPACITY %	QUANTITY Unit	COST Avg. Rate
10		.15
20		.25
30		.40
40		.60
50		.85
60		.75
70		.85
80		1.00
90		1.10
100		1.25

BASIC DATA AND REMARKS: (Indicate Source of Data)

Expense Ledger Record: (Nov. 1,1937 to Nov. 1, 1938)

	Expenditure	Avg. Per 10,000 T. F.		Avg. Per 10,000 T. F.
Electrical Supplies	$ 56		Jan.	.98
Tags	25		Feb.	.96
Staples	132		Mar.	.89
Waste	10		Apr.	.87
Total	$ 223	$ .94	May	.92
1937	189	1.06	June	.96
1936	175	1.26	July	.91
			Aug.	.88
			Sept.	.87
			Oct.	.83
			10 Month Avg.	$ .92

Interview with Foreman (J. Jones) 11-15-38

Has developed new method of attaching which will reduce staple usage 25%. Feels $.85 per 10,000 T.F. will be sufficient.

(SEE REVERSE SIDE FOR ADDITIONAL DATA)

Study Made By	Date	Checked By	Approved By
H.A.C.	11/20/38	H.D.H.	M.M.O

Figure 5. On data sheets like this Talon accumulates pertinent cost information which is reviewed in detail to insure fairness and used as a guide in setting final budgets

THE ABCs of PERSONNEL

Some well-intended consideration for subordinates, associates, and superiors will keep friction out of plant human relations, make everybody happier

CHARLES S. STEVENSON

General Manager, Hall Brothers, Inc., Kansas City, Mo.

SKETCHES BY ORIN W. LOO

Skirmishes

A tiff with the head accountant . . . an argument with the assistant superintendent . . . a warning talk about tardiness from the department head . . . an explanation to the safety committee about an oily rag in the bench drawer . . . a hurried alibi for a rush job not delivered as promised . . . a subterfuge to get off an hour early. All these incidents are skirmishes (the dictionary defines a skirmish as "a light operation evasive of the main business") and can have almost as devastating effects in business as did military skirmishes in the World War, where soldiers discovered that while skirmishes may be "light operations," being killed in one proved to be just as permanent as if the engagement were a major one.

Solicitude

"Tell Joe to drive Miss Murphy home at once; her mother was suddenly taken sick. Here are the keys to my car." . . . "That sunburn of yours looks as if it's painful, Ralph. Why don't you go down to the hospital room and get something for it?" . . . "You shouldn't be raising those heavy windows, Miss Craig. Get the stock boys to do it for you." . . . "Have that second work table moved east about ten inches; the girls will have much better light." Friendly considerations such as these won't make you an executive, but they'll make you mighty popular. Then, if you have any ability, you will have a powerhouse combination. Caution: Don't be affected or patronizing —your solicitude must be genuine and sincere.

Subordinates

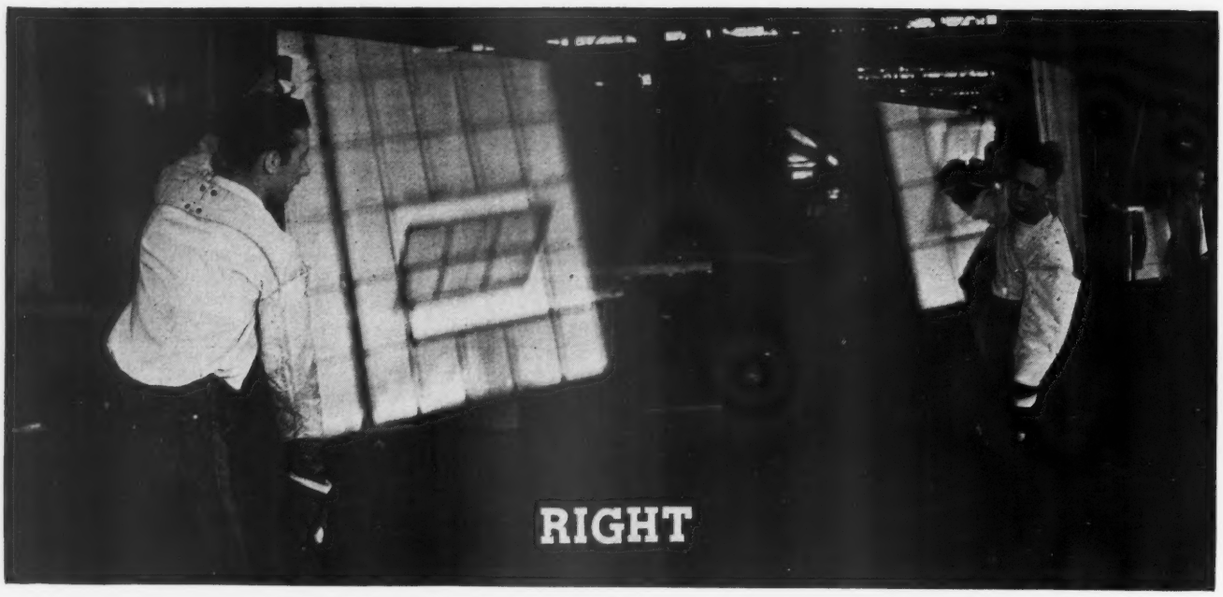
A general manager, responding to a toast on the occasion of 25 consecutive years with his organization, said, "Any degree of permanency I have attained can be definitely attributed to the fine friendly folks who have been working with me on and off these 25 years. I realize and appreciate full well that without their cooperation and help I could not possibly have stayed on this job even one year. I am deeply, deeply indebted to every individual in our organization." No executive, particularly a younger one, can possibly hope to succeed without the good will of subordinates, whose efforts and ability work together to help *him* progress. Admonition: That young lad who started work today may be president of the company some time.

Thrift

McTavish had finally been located by his Scotch friends. "Your wife was in a train wreck and hurt badly; there's already a piece in the paper about it," he was told. "Well," McTavish hesitated, "the sporting edition will be out in an hour. I believe I'll wait and read about it then." McTavish was just downright stingy, a deplorable habit. In business, thrift, a splendid trait, is definitely appreciated by management. In private life, it is enjoyed if a habit, but if a necessity, it is just plain unpleasant. Applicable to money, time, materials, supplies, tools, letter writing, the spoken word, and many other things, it is the opposite of waste, a byproduct of careful planning and almost a promissory note on security.

Time

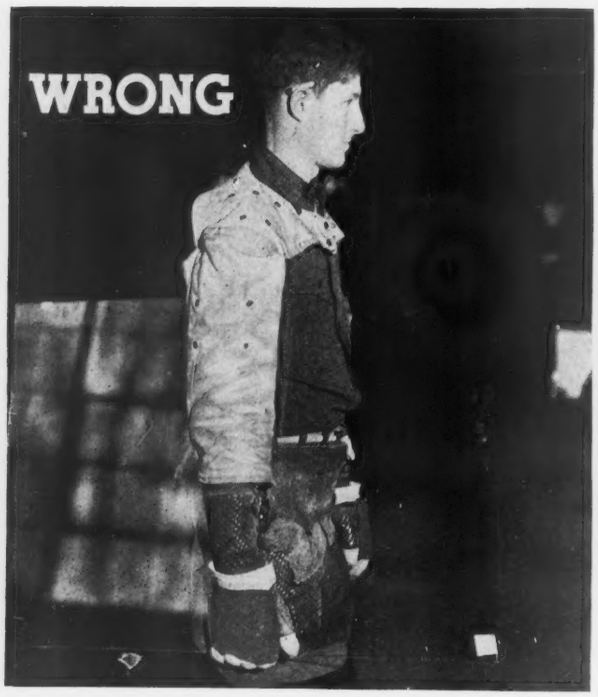
A big European shoe company has built the office of its president in an elevator cage. When he wants to consult a buyer, he operates controls that cause the elevator to move up or down to the proper floor. As the floor is reached he rings a bell for the man wanted, who comes immediately to the elevator. "After all, good men are hard to get," says the president, "saving time for several is like having *more* of them." An innovation, and certainly quite a reversal from American procedure, this idea emphasizes the extent to which men may go to save time. Remember: The difference between a great race horse and a good race horse is only a few seconds.



L-O-F employees are trained to handle glass just one way—the safe way—and are given protective equipment designed for the job; these men are wearing gloves, wrist guards, arm and shoulder protectors they must wear when moving large lights of glass

Handle Glass the Safe Way

Moving methods developed by Libbey-Owens-Ford Glass Company, and protective garments used, are recommended practice for any plant that has to handle sheet glass



Seems right at first blush because we're used to tucking things under our arms. But all wrong if we're carrying a pane of glass

L-O-F drives the lesson home by posting photographs like these on bulletin boards. Men shown in them are actual plant workers

Management Shorts

Readers are invited to contribute brief articles, illustrated when possible, reporting out-of-the-ordinary management accomplishments. Accepted articles will be paid for

PRODUCTION METHODS AND MATERIALS

Hot Bearings—One Place Where They're Wanted

SOURCE
Reliance Electric & Engineering Company, Cleveland

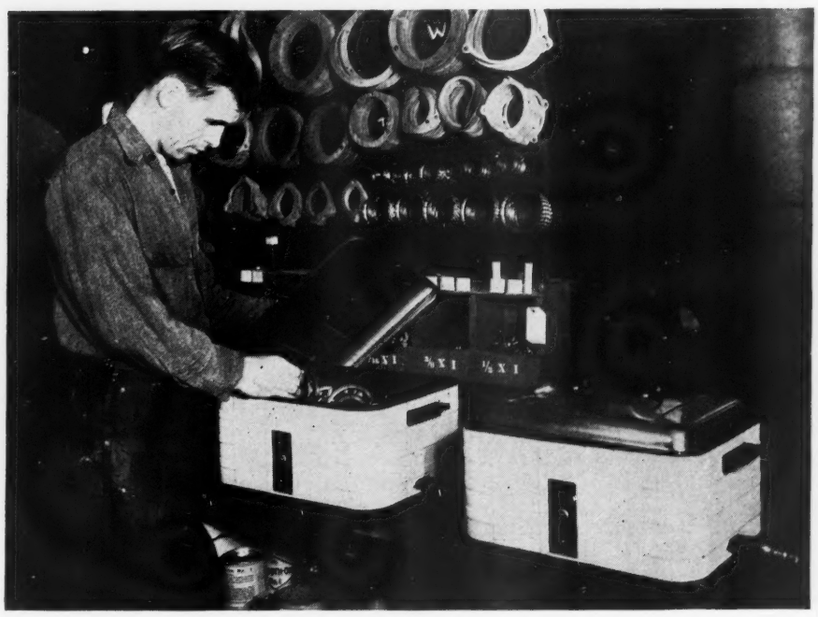
Instead of forcing ball bearings home in assembling them on the shafts of electric motors, the assembly department recently devised a simple yet effective method of heating the bearings to expand their inner races and so permit their being slipped easily to their seats on the shafts. At the same time, the close fits required are maintained.

Tests conducted in the company's experimental laboratory to determine heating time and temperature to be used, indicated that if both large and small bearings were heated to a given temperature the larger bearing would expand more than the smaller. In terms of fit, the large bearing had more clearance than a small bearing at the same temperature. This combination made it possible to keep both small and large bearings in small electric ovens for the same length of time, about two hours, getting approximately the same diametral expansion, and essentially the same clearance for assembly.

Small kitchen-type electric roaster ovens were bought because they were the cheapest (around $15 each) and the most convenient for the use required of them.

The ovens are maintained at 225 deg. F. by thermostatic control. This temperature was selected as the maximum that could safely be used without danger of drawing the temper of the bearings and without causing the bearings to lose their original supply of grease.

Bearings installed by this method insure proper fit of bearing to shaft and meet the finishing limits set for inside diameter of bearing and outside diameter of shaft. It has been found that these bearings are as readily removable as when forced on the shaft.



Bearings, expanded by heating in electric ovens, slip easily onto the motor shafts

•

Simplified Operation by Combining Parts

JOHN LUNDVALL
Time Study and Costing Engineer
Wm. Knowlton & Sons Company
West Upton, Mass.

Ribbon used as trim for ladies' hats is reinforced with buckram, a layer of buckram being sandwiched between two layers of ribbon. Formerly, the buckram was fastened to the ribbons with paste, or by layers of rubber tissue placed between each ribbon and the buckram. Two ribbons, two layers of tissue, and the buckram made five parts to handle, and it was no easy job lining them up preparatory to the ironing operation that melts the tissues and sticks the parts together.

A manufacturer was located who, after experiments, devised a buckram with a layer of rubber tissue cemented to each side. This comes on handy 25-yd. rolls, cut to the desired width, and is very convenient to handle.

Production was stepped up 300 per cent by this change.

•

Recessed-Head Screws Stop Damage During Assembly

H. S. KNOWLTON, *Boston*

When assembling finely finished parts there is always the danger that slippage of an ordinary screwdriver will mar the surface. In order to guard against such mishaps, and also improve the appearance of certain products, the General Radio Company, Cambridge, Mass., some time ago adopted the use of Phillips recessed-head screws.

For example, in assembling the ad-

justable attenuator (shown in the illustration) which is used in broadcasting and other applications, the special screwdriver used with recessed-head screws cannot slip and scratch the panel surface. With this attenuator telephone-type switches and jacks are employed. Tapped holes in the switch frames provide for standard mounting. Jacks are mounted with inside nuts and lockwashers, which fit clearance holes. The recessed screws insure a stable and secure mounting.

In the case of another product, a high-frequency resistor unit for laboratory use, recessed-head screws minimize the tendency of users to dismantle the assembly. The screws are seated in knurled, threaded inserts forced into the Bakelite case and blind-tapped.

This type of screw is also used in assembling power level indicators, the close approach to flush mounting giving a better appearance to the panel and a tighter and safer assembly.

•

With two hundred 60-in. looms to accommodate to 46-in. work, a textile manufacturer saved $15,000 in replacement parts by cutting out 14 inches from center of each loom housing, welding housings together again with oxy-acetylene torch.

•

Stroboscope Saves Time in Checking Spindle Speeds

HARRY INGLESON, *Rochelle, Ill.*

In the manufacture of yarn uniform spindle speed is one of the most important details. It must be watched constantly, to insure uniformity and high quality of product.

Policing of spindles with an ordinary tachometer or speedometer was not very convenient in our plant because of the difficulty of making contact with the ends of the shafts, and the large number of spindles involved. Use of a stroboscope has now eliminated this problem because no direct contact with any part of the machinery is necessary. With this device speed is measured by adjusting the flash rate of a lamp until the rotating part appears to stop. The reading on the scale then indicates the speed in revolutions per minute.

After the instrument has been adjusted to indicate the speed of one spindle, each spindle in the machine can readily be checked. If a spindle is slow or fast it is easily detected. Any spindle that is not turning at the proper speed is marked and examined later to determine the cause.

PRODUCTION PLANNING AND CONTROL

Controls Expense Through Record of Labor Hours

G. H. KOSKEY, *Process Manager*
Oliver Farm Equipment Company
Battle Creek, Mich.

If for some reason budgetary control is not practical, effective control of non-productive labor can be obtained by a daily record of employees similar to the one shown here. In the hands of control-minded management this record budgets hours, develops standard operating ratios, indicates deviations from standards, and above all furnishes information of day-to-day operation.

Information for this record can be supplied in a short time each morning by the departmental time clerk or checker. It should take less than an hour to make up the recapitulation in the central time office. Before noon the plant manager should have a complete picture of the previous day. A close follow-up should mean substantial reduction of non-productive expense.

Turnover is figured on departures only. Transfers are interdepartmental, and "To" and "From" should balance on the record. "P.N.P." means productive employees working on non-productive jobs; for each man occupied thus for four hours or multiples thereof, deduct half a man from productive and transfer to non-productive opposite the proper classification. Only productive hours remain on the productive side.

List non-productive labor as shown. Last column shows total working hours in all departments. This differs from total on the report as every eight hours overtime adds a non-productive man as well as one productive man, if double time is paid; if time and a half is paid, sixteen hours overtime add a non-productive man.

DAILY RECORD OF EMPLOYEES Date July 18, 1939

PRODUCTIVE												NON-PRODUCTIVE						WORKING IN DEPT.
DEPT.	TURN OVER				TRANSFER		DAILY TOTALS					CLASSIFICATION	% TO TOTAL	ON PAYROLL	ABSENT	WORKING	OVERTIME HOURS	
	HIRED	QUIT	DISCHARGED	LAID OFF	TO	FROM	ON PAYROLL	ABSENT	WORKING	OVERTIME HOURS	P.N.P. HOURS							
1						1	24	1	23		8	CRANE OPERATORS	.8	3		3		45
												CRIB ATTENDANTS	.8	3		3		
2	1	1	1				32½	2	30½	22	4	BLACKSMITHS AND HELPERS	1.1	4		4	4	48
												BRICKMASONS	.3	2	1	1		
3				2		2	17		17			FOREMEN	2.2	8		8	10	31
												" (ASSISTANTS)	2.7	11	1	10	20	
4					2		20	1	19			MECHANICS	1.6	6		6		39
												SWEEPERS	1.6	1	1	6		
10				1		2	29	1	28	12		TOOL MAKERS	3.8	15	1	14	18	50
												TRUCKERS	5.1	20	1	19		
												PRODUCTIVE WORKING NON-PRODUCTIVE	1.9	7		7		
												OVERTIME EQUIVALENT	6.5	24		24		
TOTALS	3	2	2	4	7	7	208½	12	196½	64	56			201½	10	191½	128	370

TURNOVER (260-Day basis) 5.62 CUMULATIVE TURNOVER 4.21 STANDARD RATIO NON-PRODUCTIVE 41.2% TODAY'S RATIO 50.1%

Spoilage Reduced by Identifying Its Causes

FORREST TAYLOR
Hall Brothers, Inc., Kansas City, Mo.

After moving into our new building, a step-up in production occurred, necessitating an increase in personnel. At the end of three months, our spoil-

age percentage had increased 1.4 per cent, which meant several hundred thousand cards (we manufacture greeting cards) per year. A meeting of department heads was called for the purpose of deciding upon a method to reduce the spoilage back to normal. Four fundamental causes of spoilage were identified, and we decided to do something about each of them.

1. *Nature of design.* The Source Committee (consisting of three persons) which analyzes the spoilage to find the causes, found that an outstanding reason was the nature of the design. A system was set up to have the Source Committee examine each design for spoilage risk and manufacturing procedure. This is now done where the design originates in the Creative Department. If the design will cause an excessive amount of spoilage, it is changed if possible. About 90 per cent are changed in some manner.

2. *Lack of employees' interest and knowledge of conditions.* The important thing is to get the employees interested in your problem and let them know you are interested in theirs.

A Spoilage Committee makes a tour of the manufacturing departments once each week, watching the employees perform their operations. In this way the factory spoilage is observed, and who and what departments are having trouble. A weekly broadcast is made over the plant public address system, telling all employees of any progress made and the things that cause factory spoilage, as reported by the Spoilage Committee. Photographs are taken of the spoilage, and these pictures are posted on the bulletin boards. The condition is soon corrected. Everyone makes an effort to keep pictures of his department off the board.

At the completion of an order, the spoilage percentage is figured, and, if excessive, a special label is sent to the Order Department to be put on a re-run job ticket, warning those concerned to handle the stock with care.

3. *Insufficient training of new employees.* Handling paper without creasing it and getting finger prints on it is something that has to be learned. Before new employees are put on such a job, they first attend classes of stock handling, conducted by the supervisors and older employees. If a person is transferred to a new job, he has a special supervisor who works very closely with him until he has become acquainted enough with the problem to go on by himself.

Since stock handling causes about one-half the spoilage, we made a list of "don'ts" which are statements that tell employees what not to do. These are printed on individual slips and passed out to everyone in the entire factory who handles stock. A different "don't" is received every two days for one month. This is a constant reminder to handle stock carefully. When we see our stock handling spoilage go up, we send them around again.

4. *Improper planning.* A list of paper stocks that cause a high spoilage is sent to the Planning Department which sees that this stock is used only on designs taking a fewer number of operations to complete. Some kinds of stock are suited for printed designs, others for lithographed, while some should never be die-cut. Types of designs that cause a high spoilage are sent to the Planning Department which uses them as few times as possible without restricting variety.

After working this plan for some time, we find that the spoilage has dropped far below what we hoped for.

•

Motorcycle Messengers Carry Messages and Stock

SOURCE

Illinois Central Railroad Company

Boxes in which messages and stock and tool requisitions can be placed by shop foremen are serviced at approximately 15-min. intervals by motorcycle messengers in Paducah Shops of the Illinois Central System. The motorcycles are equipped with sidecars large enough to permit handling a sizable load of tools and material.

If the foreman needs materials, tools, or the services of a maintenance man and is not in a tremendous hurry about it, he makes out a ticket and drops it in his mailbox. In a rush, he telephones in, and sends a written ticket in confirmation by the next delivery.

The motorcycle men pick up the tickets on one trip, deliver the material

on the next trip. For heavier items than the sidecar can handle, the motorcycle man directs the loading of these items on a skid or trailer for delivery by lift truck or tractor.

Delivery of material in this organized manner with motorcycles, lift trucks, crane trucks, and tractors has brought about a saving of 45 per cent over the old method of letting shopmen call for their own material, with consequent loss of time from their work.

✦ ✦ ✦

IN NOVEMBER — MORE QUICK WAYS TO PROFITS

"Reading through this issue at home Friday evening, I checked 27 items which I am sending out to 14 people in our organization"

"I am asking operating men in my department to list 10 specific items they think will be helpful to our own factory operation"

"There is no question that this issue of FACTORY will stimulate our foremen, superintendents, and workers as well, to figure out for themselves short cuts they never thought of before"

"I am in the midst of reviewing November FACTORY in detail, after which I propose to hand the issue to our methods department and ask them to check each suggestion for possible use in our plant"

The above are typical reader comments on last November's *"500 Quick Ways to Profits."* They suggest reasons why plant operating men cannot afford to miss this November's *"Quick Ways to Profits"*

Vestibule Schools

How they served industry during the World War

WAR IN EUROPE, if previous experience is any guide, means busy factories —and busy factories, whatever the extent of our participation in a war, will undoubtedly mean a labor shortage. And not just a shortage of skilled labor, which indeed in some trades and in some industrial communities has long since begun to show up, but a shortage of unskilled help—of machine operators, assemblers, and the like.

Industry faced a similar shortage during the World War, and as many plant operating men will recall, met it with a device known as the "vestibule school," so called because it was almost literally on the threshold of the shop and because new workers had to pass through it on the way to jobs at the production lines. This type of training activity, it is to be remembered, actually turned out reasonably competent machine operators in comparatively few days' time.

Right now would therefore seem an appropriate moment to revive interest in the vestibule school. It is not at all to imply that the time has already come when industry must adopt similarly drastic training measures. It is merely to suggest that the vestibule school be looked into, kept as an ace in the hole.

So, what were these vestibule schools we've all heard so much about? And how does one go about setting one up and then running it?

Training 5,000 Women

The answers to these questions are best sought in management literature current during World War days, one of the earliest references being found in *Industrial Management* (now consolidated with FACTORY) for May, 1918, in "Training 5,000 Women for Precision Work," by C. U. Carpenter.

Mr. Carpenter cited the experience of The Recording & Computing Machines Company, a Dayton concern of which he was vice-president and general manager. At that time the company was employing some 8,600 people. Practically all machine operations, as well as assembly and inspection work, were being performed by women who up to a few months before had scarcely seen a machine, much less run one.

Work in this shop was of a close nature. The product was the Russian combination time fuse. Tolerances ran as low as 0.0005 inch.

The equipment included hydraulic presses, punch presses, milling machines of all types, hand turret screw machines, automatic screw machines, thread millers, drill presses, and many other company-built special-purpose machines.

Men were scarce. But the company knew there must be plenty of women, intelligent, healthy, quick, and earnest, but barred from employment because of their utter ignorance of what it takes to run a machine.

First attempts to induct women into machine-operating jobs were only partially successful. Mr. Carpenter noticed particularly that "when new girls came into the shop they were very nervous—badly frightened—and would often break down and weep because of the actual fear that took hold of them when they first stood before a big machine tool, the like of which they had never seen before, the uses of which they could not conceive . . . The more earnest a girl was, the greater her terror, and the net result was that the foreman in his impatience promptly and continuously fired the best class of employees that it was possible to get."

Not only that, but those who managed to stick were slow to learn, took a good deal of the other operatives' time, more often than not learned bad methods. And their percentage of scrap was heavy.

So the company started a training school. It was located in a room entirely separate from the factory. Special care

(*Continued on page* 124)

✦ ✦ ✦

Plant Sabotage

What industry can do to prevent it

NO AUTHENTICATED CASE of war-connected industrial or maritime sabotage has as yet been reported in this country since the start of Europe's new conflict. Possibly none will. But the problem, in World War days, was a serious one, especially in the years *before* America entered the war.

The lessons of 1915–17 should not be lost either on industry or government today. In that earlier period, management was unsuspecting, to say the least, while our government was nothing less than naive in its assumption that the agents of one belligerent would never stoop to violent interference with a neutral nation's industry and commerce even when these were engaged in another belligerent's service. The fallacy of this assumption was presently demonstrated at a cost to American industry that has been estimated at $150,000,000 in material damage exclusive of losses in production and profits.

Incendiary fires and explosions were the saboteur's chief activities. Principal targets were plants manufacturing munitions for belligerent nations and ships carrying munitions or supplies to war zone ports. American unpreparedness was undoubtedly an invaluable aid to the undercover operator. The U. S. Army Military Intelligence service had a budget of only $11,000 in 1916. The Department of Justice was uncertain of its power to act until passage of the Espionage Act. Thus the early work of detection was left largely to local police forces and to the managements and shippers concerned, many of whom were not initially alert to the danger.

Preventive action proved finally to be the most effective answer to the sabotage question. While today the matter must be viewed calmly, it should not be ignored. At any rate, a timely warning is given to management through FACTORY, by officials of the National Fire Protection Association:

"It is only a matter of common sense and sound precaution for American industry to devote time and thought to effective measures for the prevention of sabotage in the present war emergency," says Percy Bugbee, General Manager of the Association. "There is no doubt at all that fires of mysterious origin occurred with startling frequency on ships and in factories during the last World War. The setting of fires has always been a favored weapon of the spy and trouble maker."

Some of the techniques of sabotage were revealed after the war by Captain Henry Landau, former British Secret Service officer and consultant to American firms in mixed claims cases. Many of Landau's findings, published in his book, "The Enemy Within," are con-

(*Continued on page* 132)

How to Rate Jobs and Men

A. L. KRESS

Director of Industrial Relations
National Metal Trades Association
Chicago

Presenting here, in Part One, the National Metal Trades Association's Job Rating Plan, already successfully installed in over 100 plants ranging from 25 to 2,000 employees and covering anywhere from 10 to 450 jobs; in Part Two (also in this special section), the Association's Employee Rating Plan, just out of committee and ready to use. Both plans are easily understood and applied, are offered here because the editors believe a sound wage payment program is the first step toward good industrial relations. Only when management measures jobs and men factually can it hope to administer its wage plans fairly. Although designed for NMTA's 800-odd members in the metal-working industries, the two plans are adaptable to any plant in any industry. There is nothing indeed to prevent groups of totally unrelated plants from making area wage surveys similar to those described here

FACTORY MANAGEMENT and MAINTENANCE

Thirty-eighth in the Series of FACTORY MANAGEMENT and MAINTENANCE Plant Operation Library

PART ONE

Rating the Job

How can management secure and keep the interest, cooperation, and loyalty of every employee? This is almost universally recognized as the basic problem in industrial relations.

It is obvious that no one single act or policy can be exclusively relied upon to attain this objective; good industrial relations is the composite result of a number of policies, acts, and attitudes. It is equally obvious that there can be no such thing as good industrial relations without a sound wage program.

There are two fundamentals in a sound wage payment policy:

1. Adoption of a fair wage level, which should be at least equal to the rates paid for comparable work in the community.

2. Establishment of fair wage differentials between jobs, based on relative skill, effort, and responsibility.

For many years the National Metal Trades Association had made periodic area wage surveys from which its member companies could determine whether their own general wage level was above or below that of the area, and how they compared on specific jobs or occupations. It became increasingly evident, however, that surveys based on job names alone (such as "assembler," "millwright," or "welder") were inadequate for comparison purposes since the character of the work varied widely from one plant to another.

In other words, a valid comparison of wage rates for assemblers can be made only when we know the type of assembly work involved. Obviously no valid comparison can be made between rates of pay for assembling electric toasters and diesel engines, yet both involve assembly jobs.

Also, although many companies were interested in the problem of wage differentials within a plant, there was little or no information available as to how to appraise existing differentials.

Some two years ago, therefore, the Association set up a Job Rating Committee to determine:

1. How companies could appraise their wage differentials.

2. Whether the association could or should recommend the use of a single job rating plan by all members.

3. How to improve its wage survey methods so that employers could better appraise their own wage levels.

The Committee spent several months making a careful survey of all phases of the problem. It analyzed and compared practically all the job rating plans in use. It debated whether a single rating plan could be successfully applied to some 800 plants making engines, machine tools, materials handling equipment, and the countless other products of the metal trades. It also debated its possible application to such a wide variety of jobs as are found in foundry, forge shop, structural, woodworking, and metal working operations.

The Committee finally concluded that the right rating plan could be fairly and successfully applied to all metal trades plants, that actually one of the primary objectives — the making of valid wage comparisons between plants —could only be attained by the consistent application of a single plan.

Tests of a Good Plan

The Committee then sought to lay down some tests of a rating plan, finally arriving at the following:

1. The plan should be simple and easily understood by everyone involved.

2. It should be so designed as to secure consistency in its application both in the individual plant and between plants.

3. It should incorporate and weight such essential factors or job characteristics as education, experience and physical effort.

Should a new plan be devised? Or could an existing plan be adopted or adapted? It was found that the National Electrical Manufacturers Association had previously recommended a job rating plan to its membership which had been thoroughly tested. Since the NEMA plan met the requirements laid down by the NMTA, the committee recommended its adoption.

Over 10,000 jobs in more than 100 plants have since been rated and classified. The plan is simple and easily understood. Jobs are rated according to eleven factors common to all types of manufacturing. *Skill*, which is broken down into (1) education, (2) experience, and (3) initiative or ingenuity, is assigned 50 points. *Effort*, comprising (4) physical demand, and (5) mental or visual demand, is assigned 15 points. *Responsibility*, for (6) equipment or process, (7) material or product, (8) safety of others, and (9) work of others, gets a total of 20 points. *Job Conditions*, including (10) working conditions and (11) unavoidable hazards, are rated a total of 15 points.

These eleven factors and the points

ABOUT THE AUTHOR

A. L. KRESS, after 21 years in industry, went back to school, was graduated from Harvard School of Business Administration. Prior to that he spent seven years as everything from rodman to resident engineer on railroad, power plant, water and sewage construction, and land drainage projects. During the War he served as purchasing agent for a Canadian company making 9.2 shells.

For thirteen years after the War he was an industrial engineer with U. S. Rubber Company—first for a single plant, then for a division of ten plants, finally as manager of industrial engineering for the entire company. During this time he directed the installation of standard time, replacing piecework, in fifteen plants; the operation of a standard cost system covering six plants; cost reduction surveys, plant layouts, and consolidation studies.

Did a year as Deputy Administrator for the Rubber Industry under NRA.

Spent four years with National Electrical Manufacturers Association as Director of Code Administration, later as Director of Industrial Relations and uniform accounting activities. Was borrowed by National Metal Trades Association in July, 1938, to direct its new job rating program. Since July 1, 1939, has served as Director of Industrial Relations for the latter Association

Occ. Code No. _____

Dept. _____

JOB RATING - SUBSTANTIATING DATA

Job Name LATHE OPERATOR - ENGINE (Up to 30") Class A

FACTORS	DEG.	BASIS OF RATING
EDUCATION	3 (42)	Use shop mathematics, charts, tables, hand book formulas. Work from complicated drawings. Use micrometers, depth gauges, indicator gauges, protractors. Knowledge of machining methods, tools, cutting qualities of different kinds of metals. Equivalent to 2 years high school plus 2 to 3 years trades training.
EXPERIENCE	4 (88)	3 to 5 years on wide variety of engine lathe work, including diversified set-ups.
INITIATIVE AND INGENUITY	4 (56)	Wide variety of castings and forgings of complicated form. Close tolerances. Difficult set-ups of irregular shaped parts. Considerable judgment and ingenuity to plan and layout unusual lathe operations, select proper feeds and speeds, devise tooling, for varying materials and conditions.
PHYSICAL DEMAND	2 (20)	Light physical effort. Set-ups may require handling of heavy material mounting on face-plate. Machine time greatest part of cycle. Most of time spent watching work, checking, making adjustments.
MENTAL OR VISUAL DEMAND	4 (20)	Must concentrate mental and visual attention closely, planning and laying out work, checking, making adjustments. Close tolerances may require unusual attention.
RESPONSIBILITY FOR EQUIPMENT OR PROCESS	3 (15)	Careless set-up or operation, jamming of tools, dropping work on ways, jamming carriage, may cause damage seldom over $250.
RESPONSIBILITY FOR MATERIAL OR PRODUCT	3 (15)	Careless set-up or operation may result in spoilage and possible scrapping of expensive castings, forgings, shafts, etc., e.g., machining below size, inaccurate boring of diameter and depth. Probable losses seldom over $250.
RESPONSIBILITY FOR SAFETY OF OTHERS	3 (15)	Flying chips may cause burns, cuts or eye injuries. Improperly fastened work may fly from face plate or chuck. May injure another employe when setting work in machine.
RESPONSIBILITY FOR WORK OF OTHERS	1 (5)	None.
WORKING CONDITIONS	2 (20)	Good working conditions. May be slightly dirty, especially in set-ups. Some dust from castings. Usual machine shop noise.
UNAVOIDABLE HAZARDS	3 (15)	May crush fingers or toes handling material or from dropped tools or clamps. Possible burns, cuts or eye injury from flying chips and particles. Finger or hand injury from rotating work.
Remarks 311-4		

Figure 1. Some 350 master sheets like this have been developed to expedite the actual task of rating jobs. When a specific job is rated, any one of three things can happen: (1) The master can be used "as is" or (2) adapted; or (3) a new one can be worked up

JOB RATING SUMMARY BY LABOR GRADES

PRODUCTIVE JOBS - MACHINE SHOP

OCC. CODE NO.	OCCUPATION	CLASS	LABOR GRADE	TOTAL POINTS	SKILL						EFFORT				RESPONSIBILITY								JOB CONDITIONS			
					EDUCATION		EXPERIENCE		INITIATIVE AND INGENUITY		PHYSICAL DEMAND		MENTAL-VISUAL		EQUIP. OR PROCESS		MATERIAL OR PRODUCT		SAFETY OF OTHERS		WORK OF OTHERS		WORKING CONDI-TIONS		HAZARDS	
					DEG.	PTS.	DEG.	PTS.	DEG.	PTS.	DEG.	PTS.	DEG.	PTS.	DEG.	PTS.	DEG.	PTS.	DEG	PTS.	DEG.	PTS.	DEG.	PTS.	DEG.	PTS.
													Labor		Grade		2									
104	Lay-Out Man	A	2	347	4	56	5	110	4	56	2	20	4	20	2	10	4	20	3	15	1	5	2	20	3	15
55	Boring Bar-Horizontal	A		343	3	42	5	110	4	56	3	30	4	20	3	15	3	15	3	15	1	5	2	20	3	15
45	Assembler-Group Leader	A		341	3	42	4	88	4	56	3	30	4	20	2	10	2	10	3	15	5	25	3	30	3	15
													Labor		Grade		3									
85	Inspector-Mechanical	B	3	335	4	56	4	88	4	56	2	20	4	20	3	15	3	15	3	15	3	15	2	20	3	15
122	Set-Up Man-Welding	A		331	3	42	4	88	4	56	3	30	4	20	2	10	2	10	3	15	3	15	3	30	3	15
125	Sheet Metal Worker	A		331	3	42	4	88	4	56	3	30	3	15	3	15	2	10	3	15	1	5	4	40	3	15
103	Lay-Out Man	A		327	4	56	5	110	4	56	2	20	4	20	2	10	2	10	2	10	1	5	2	20	2	10
76	Grinder-External	A		326	3	42	4	88	4	56	3	30	4	20	3	15	2	10	3	15	1	5	3	30	3	15
78	Grinder-Internal	A		326	3	42	4	88	4	56	3	30	4	20	3	15	2	10	3	15	1	5	3	30	3	15
97	Lathe Operator-Turret	A		326	3	42	4	88	4	56	3	30	4	20	3	15	2	10	3	15	1	5	3	30	3	15
116	Planer Operator	A		326	3	42	4	88	4	56	3	30	4	20	4	20	3	15	3	15	1	5	2	20	3	15
58	Boring Mill Operator	A		321	3	42	4	88	4	56	3	30	4	20	3	15	3	15	3	15	1	5	2	20	3	15
91	Lathe Operator-Engine	A		321	3	42	4	88	4	56	3	30	4	20	3	15	3	15	3	15	1	5	2	20	3	15
90	Lathe Operator-Engine	A		316	3	42	4	88	4	56	3	30	4	20	3	15	2	10	3	15	1	5	2	20	3	15
96	Lathe Operator-Turret	A		316	3	42	4	88	4	56	3	30	4	20	3	15	2	10	3	15	1	5	2	20	3	15
108	Milling Machine Operator	A		316	3	42	4	88	4	56	3	30	4	20	3	15	2	10	3	15	1	5	2	20	3	15
109	Milling Machine Operator	A		316	3	42	4	88	4	56	3	30	4	20	3	15	2	10	3	15	1	5	2	20	3	15
													Labor		Grade		4									
130	Welder-Arc	A	4	314	3	42	3	66	4	56	3	30	3	15	2	10	4	20	3	15	1	5	4	40	3	15
56	Boring Bar-Horizontal	B		307	3	42	4	88	3	42	3	30	4	20	3	15	3	15	3	15	1	5	2	20	3	15
105	Lay-Out Man	B		306	4	56	4	88	3	42	2	20	4	20	2	10	3	15	3	15	1	5	2	20	3	15
83	Heat Treater	-		305	3	42	3	66	3	42	3	30	3	15	4	20	3	15	3	15	1	5	4	40	3	15
67	Drill Press Operator-Radial	A		302	3	42	4	88	3	42	3	30	4	20	3	15	2	10	3	15	1	5	2	20	3	15
113	Miller - Worm Thread	-		300	3	42	3	66	3	42	4	40	4	20	3	15	2	10	3	15	1	5	3	30	3	15
110	Milling Machine Operator	B		299	3	42	3	66	4	56	3	30	4	20	3	15	3	15	3	15	1	5	2	20	3	15
120	Punch Press-Set-Up Man	B		296	2	28	3	66	3	42	3	30	3	15	3	15	2	10	4	20	3	15	4	40	3	15
126	Sheet Metal Worker	B		295	3	42	3	66	3	42	3	30	3	15	3	15	2	10	3	15	1	5	4	40	3	15
86	Inspector-Mechanical	C		294	4	56	3	66	3	42	2	20	3	15	3	15	3	15	3	15	3	15	2	20	3	15

Figure 2. When all the jobs in a department have been rated, they are summarized and graded according to total scores. All ratings are then carefully checked and compared

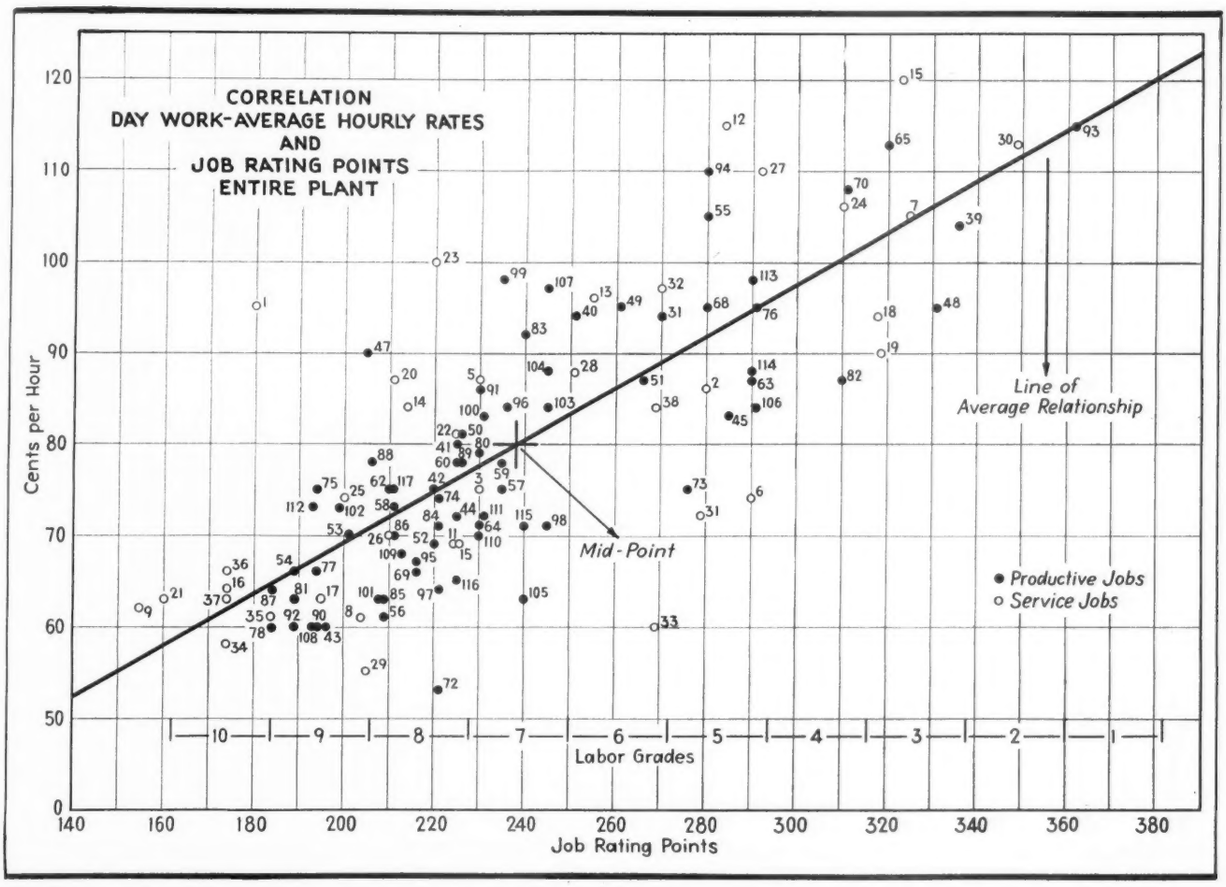


Figure 3. From this picture, and also from similar charts for jobs on incentive and maintenance jobs, management can see at once which jobs are out of line. All jobs are identified by code numbers and plotted according to earnings and rating points scored

assigned to each are shown in Table I. It will be seen that each factor is broken down into five degrees. For example, Table II shows the specifications for rating a job on *responsibility* for material or product. The other ten factors are similarly described for rating purposes.

To simplify and expedite the rating of jobs in a plant, the Association has prepared some 350 master sheets which constitute a valuable collection of job specifications for a wide range of occupations. Sample master sheet is shown in Figure 1.

In rating jobs, one of three possible situations comes up:

1. A master sheet can be adapted to fit the specific job or operation that is under consideration.

2. The master sheet fits the specific job without any change.

3. The specific job must be written up in its entirety either because it is peculiar to the plant or there is no master describing it.

The foreman plays an important part in the application of the Metal Trades job rating plan. He furnishes the basic information as to what each job in his department takes, in terms of each one of the eleven factors, and participates in the rating itself.

In utilizing the master ratings, the requirements of a specific job are checked against the master specifications. Wherever the requirements differ, the differences are recorded in the rating for that job. Suppose the foreman says he has some first-class assembly work. In developing the job specification, he says it takes one to two years' experience, with no previous trades training. Reference to the master rating, however, shows that Class A Assemblers usually require over five years' experience. Obviously, then, the local job should not be classified as "A" in terms of the broad industry job classification. Otherwise the resulting

TABLE I—POINTS ASSIGNED TO FACTORS

	1st Degree	*2nd Degree*	*3rd Degree*	*4th Degree*	*5th Degree*
Skill					
1. Education	14	28	42	56	70
2. Experience	22	44	66	88	110
3. Initiative & Ingenuity	14	28	42	56	70
Effort					
4. Physical Demand	10	20	30	40	50
5. Mental or Visual Demand	5	10	15	20	25
Responsibility					
6. Equipment or Process	5	10	15	20	25
7. Material or Product	5	10	15	20	25
8. Safety of Others	5	10	15	20	25
9. Work of Others	5	..	15	..	25
Job Conditions					
10. Working Conditions	10	20	30	40	50
11. Unavoidable Hazards	5	10	15	20	25

TABLE II—RESPONSIBILITY FOR MATERIAL OR PRODUCT

Requirements

1st Degree	Value of material which may be wasted, damaged or lost is small (maximum $10.00) or possibility of loss or damage is slight.
2nd Degree	Probable loss due to damage or waste of materials or product is low (maximum $100.00).
3rd Degree	Probable loss due to damage or waste of material or product is limited (maximum $250.00) or if amount of possible loss is high, probability of occurrence is exceedingly low.
4th Degree	Probable loss due to waste or damage of material or product is high (maximum $500.00).
5th Degree	Value of material which may be wasted, damaged, or lost by the employee is very high, up to several thousand dollars.

wage survey data will not be truly comparable.

When all jobs in each department of the plant have been rated, a summary sheet (Figure 2) is made up. Jobs are arranged by grades according to total points scored. The summary sheets are then carefully reviewed with top management to check possible inconsistencies. If there are a large number of, say, assemblers in several departments, then their ratings are all brought together on single summary sheets for checking and comparison. In this way almost every possible chance for inconsistency is eliminated.

Top management is then supplied with a picture of its wage structure (Figure 3). This is a simple correlation chart on which jobs are plotted according to hourly earnings (left-hand scale) and points scored (bottom scale). If the job rating plan really measures the equivalent skill, effort, responsibility, and job conditions pertaining to different jobs, then rates of pay should increase as the points scored increase.

Such a chart therefore shows management which jobs are "out of line," either because they pay too much or too little in relation to other jobs in the plant. This does not mean a drastic adjustment of rates is in order. As one plant manager puts it, "It took us 25 years to get this way. It's not unreasonable if it takes five years to straighten it out." But it does mean that top management has a fair and logical basis for the gradual elimination of inequalities and unfairness. As a matter of fact, it is only through application of a job rating plan that manage-

WAGE SURVEY SUMMARY — Branch ____ Period Oct.-Dec. 1938 Issued March 1939

NATIONAL METAL TRADES ASSOCIATION — AVERAGE HOURLY EARNINGS—CENTS — Based on Reports from 23 Plants — SHEET No. 1

No. Plants	No. Employees	Aver. Hourly Earnings	OCCUPATION *	Class	D or Inc.	40 to 42½	42½ to 45	45 to 47½	47½ to 50	50 to 52½	52½ to 55	55 to 57½	57½ to 60	60 to 62½	62½ to 65	65 to 67½	67½ to 70	70 to 72½	72½ to 75	75 to 77½	77½ to 80	80 to 85	85 to 90	90 to 95	95 to 1.00	1.00 to 1.05	1.05 to 1.10	1.10 to 1.15	1.15 to 1.20	1.20 to 1.25
			MAINTENANCE OR SERVICE		D																									
					Co.																									
					I																									
	326-3		1 CARPENTER	A	D																									
					Co.																									
					I																									
9	13	.79	2 286 CARPENTER	B	D											2	4	1	1			2			1	1				
	295-4				Co.																									
					I																									
4	14	.63	3 225 CARPENTER	C	D								1	5	6		1			1										
	225-8				Co.																									
					I																									
			CLERK—SHOP		D																									
					Co.																									
					I																									
4	27	.65	4 264 CRANEMAN	A	D							1		8	8	4	1		1	3	1									
	267-6				Co.																									
					I																									
9	42	.64	5 248 CRANEMAN	B	D							3	5	4	2	17	6	3	1			1								
	240-7				Co.																									
					I																									
					D																									
	355-2		ELECTRICIAN	A	Co.																									
					I																									
9	25	.83	6 319 ELECTRICIAN	B	D													4	2	3	1	5	6	1		1	1	1		
	328-3				Co.																									
					I																									
5	10	.73	7 290 ELECTRICIAN	C	D									2		1			1	3		3								
	290-5				Co.																									
					I																									
					D																									
	164-10		ELEVATOR OPERATOR		Co.																									
					I																									
5	18	.61	8 262 HITCHER	A	D					1			4	6	3	3	1													
	267-6				Co.																									
					I																									
2	17	.78	9 265 FIREMAN		D											4			5				8							
					Co.																									
					I																									
9	27	.56	10 224 HELPER—TRADES		D					3	4	1	3	6	3	5		2												
	225-8				Co.																									
					I																									
13	100	.57	11 193 LABORER		D		1			6	11	47	14	13	1	3	1	2			1									
	195-9				Co.																									
3	4	.65	193		I					1		1						1				1								
16	82	.56	12 174 JANITOR—SWEEPER		D			1		32	4	28	6	5		2	1			1		2								
	174-10				Co.																									
					I																									
3	20	.96	13 353 MACHINIST	A	D																	3	3	3	3	6	1		1	
	350-2				Co.																									
					I																									
8	32	.92	14 334 MACHINIST	B	D												1	1	3	2		16	7	2						
	323-3				Co.																									
					I																									
2	7	.79	15 285 MACHINIST	C	D											1				2	2		1	1						
	285-5				Co.																									
					I																									

* See Wage Survey Schedule for Job Descriptions.

Figure 4. Final step is the compilation of area wage surveys which include charts like that shown in Figure 3, but covering, as in this case, a large number of plants in a given manufacturing area. This is one of eight sheets on which all jobs have been listed

ment can be assured that rates of pay are comparable for different jobs and that discrimination in rates of pay is being minimized.

It should be noted that Figure 3 is a correlation of all plant jobs on day rate only. Similar charts are prepared for productive jobs on incentive and maintenance jobs on day work.

Final step in the Metal Trades plan is the compilation of area wage surveys based on the job classifications and ratings in each plant. In this way a plant with Class A, B, and C Assemblers may make comparisons of its own wage rates in terms of comparable work. Such a survey covering 23 plants in one industrial area was recently completed. It shows in a series of charts the general level of wages for maintenance jobs on day work, productive jobs on day work, and productive jobs on wage incentive. (See Figure 4 on the facing page.)

Does it work? A foreman in a Middle Western plant was called in to rate his jobs, and the plan was explained to him. Without any hesitation he said: "I can see where the company is going to get two things out of this. It is going to find out first whether the men in my department are being paid fairly, and second, whether I happen to know my job."

There, simply and clearly stated, are two tangible results from applying the Metal Trades plan. In the average plant top management does not possess enough factual information as to jobs and men to appraise their worth fairly and accurately. These things are too important to be left to expediency or opportunism. Without a clear-cut classification of work, and hence of jobs, without a factual basis for appraising jobs, inequalities in rates of pay are inevitable. Management owes it to its supervisory force to make this modern tool available, because it:

1. Enables management to appraise the fairness of its wage structure.

2. Points out potential sources of dissatisfaction that may arise because of inequalities in earnings.

3. Enables management to appraise the kind of job that is being done in setting standards and base rates.

4. Helps the supervisory force to think objectively in terms of jobs.

5. Helps minimize the danger of inequities and favoritism.

6. Furnishes a factual basis for the determination of wage differentials, for the discussion of differences in wage rates, or for wage negotiations. Properly applied, it substitutes incontrovertible facts for mere guesswork.

DOES JIM BLANK RATE A RAISE?

"The contents of this envelope should be a confidential matter between you and the management," reads a statement on Jim Blank's weekly pay envelope.

"They needn't worry," mutters Jim as he steps away from the paymaster's window. "I'm as ashamed of it as they are."

But suppose, after thinking things over, Jim finally goes to his foreman and says he isn't satisfied with his earnings. The foreman may take one of three courses, depending on the way top management has encouraged him to deal with such cases. He may:

1. Tell Jim if he doesn't like it he knows what he can do.

2. Lead Jim to believe he agrees with him and would fix it if he had anything to say about it—but "they" won't let him. This makes the foreman a good fellow at top management's expense.

3. Say he'll be glad to check up and let Jim know in a few days.

The foreman believes in giving his men a square deal, so sends the complaint up the line. In deciding whether Jim's complaint is justified, management should ask and answer three questions:

1. What about Jim Blank's job? How does it compare with other jobs in the department?

2. What about Jim? How does he compare with the other men on the same job?

3. What do other companies in the area pay for similar jobs?

Only when management has the facts on these points is it in position to judge whether this complaint of Jim's has any real merit

PART TWO

Rating the Man

How does one employee compare with another in terms of performance and value to the organization? How much more, or less, is one person worth than others doing the same work? Who are promotion prospects because of their interest, knowledge of their jobs, and outside efforts to improve themselves and qualify for advancement? If a man asks for an increase, is he worth it, compared with other men on the same job? These questions come up all the time, and management (the supervisory force is definitely a part of management) is continually trying to answer them fairly.

Such questions can be answered on the basis of general impressions, opinions, or "hunches," or by trying to appraise individuals in terms of definite performance factors. The persons who are affected by these decisions are, of course, deeply concerned.

Obviously, here is one of the most concrete places to promote sound industrial relations. Management should see to it that its decisions are based on facts rather than on guesses, on a consistent, well-thought-out policy rather than on expediency and opportunism, on fairness and reasonableness rather than on prejudice and arbitrary action. These are signposts along the road to sound industrial relations. *This evaluation of individual ability and performance is a definite responsibility of management.* It cannot be properly delegated or shared. Management alone can determine the relative value of individuals and their place in the organization.

The National Metal Trades Association has developed an employee rating plan as a contribution to the better appraisal and reward of individual performance. Many similar plans have been devised and are in use. The Metal Trades plan, herein described, is simple, easily understood, and readily applied.

Such a plan, properly applied, can:

1. Assist top management in eliminating unwarranted inequalities or differences in rates of pay.

2. Provide a factual basis for wage adjustments or for decisions as to transfers, promotions, lay-offs, or dismissals.

3. Indicate the potential possibilities of employees and thus furnish an intelligent basis for promotion.

4. Enable the supervisory force to do a better job in appraising individuals by giving foremen some concrete factors against which to evaluate personal performance.

5. Develop an increased spirit of fairness and impartiality, on the part of the supervisory force, in their employee relations.

6. Enable the supervisory force to become more alert, analytical, and careful in appraising men.

7. Stimulate interest in self-improvement on the part of employees, where the ratings are used in a friendly way to point out short-comings.

8. Develop confidence in management's fairness and sincerity.

There are three steps in developing an employee rating plan:

1. Selecting the factors against which performance is to be rated.

2. Determining the weights or points to be given each.

3. Writing up a specification for each degree of each factor.

There can be differences of opinion as to the factors to be used or in the points to be given each. This does not necessarily mean that any one plan is better than another. As long as a plan is well thought out, easily understood, and consistently applied, it will give satisfactory results. The factors selected should be few in number and capable of being described in concrete terms. In finally classifying employees, five groups are recommended:

Group	*Point Range*
1	91 to 100
2	81 and under 91
3	71 and under 81
4	61 and under 71
5	60 or below

The six basic factors included in the Metal Trades plan and the points assigned to each are shown in Table III. It is thus possible to recognize eight different degrees in rating an employee on any one factor. The specifications for each are shown on the rating sheet.

A company may, if it wishes, modify the rating plan, either by changing the total points (or weight) assigned to the factors, or by adding or substituting factors, provided that:

1. Total maximum points always equal 100. Likewise, the totals 30, 40, 50, 60, 70, 80, 90 for each of the other degrees should be retained.

2. If any new factors are added, the same type of questions are developed for them as shown on the rating sheet for the above six factors.

If a company decides that employee rating can be a valuable tool of management, let us see what must be done to adopt the Metal Trades plan:

1. The company should decide whether it wishes to adopt the plan as outlined, or whether it prefers to modify the plan by changing the factors or weights. In the application of the NMTA *job rating plan* (see Part One), companies are urged to make no changes, since consistency in ratings between plants is essential for wage surveys. The employee rating plan may, however, be modified, if a company so desires.

2. Once decided on, the plan should be explained carefully to the supervisory force. The foremen are the key men in the actual rating and must understand the plan thoroughly, be sold on its value, and be told why the company has adopted it and what the expected advantages are. Unless this is done the ratings will be of little value.

3. It should be constantly emphasized that the value of employee rating depends entirely upon the fairness with which the ratings are made. Personal likes, dislikes, snap judgment, or superficial opinions should be eliminated as far as possible.

4. A rating sheet should be drawn up—see Figure 5. Note that the NMTA report helps to answer three questions: What has he done? What can he do? Can you rely on him?

TABLE III—POINT VALUES FOR RATING EMPLOYEES

Factor	R-1	R-2	R-3	R-4	R-5	R-6	R-7	R-8
1. Quality of Work	25	23	20	18	15	13	10	8
2. Quantity of Work	20	18	16	14	12	10	8	6
3. Adaptability	15	13	12	10	9	7	6	4
4. Job Knowledge	20	18	16	14	12	10	8	6
5. Dependability	10	9	8	7	6	5	4	3
6. Attitude	10	9	8	7	6	5	4	3
Totals	100	90	80	70	60	50	40	30

EMPLOYE RATING REPORT

NAME_____ NO._____ TOTAL POINTS_____ GROUP_____

DEPT._____ OCCUPATION_____ CLASS_____

RATED BY_____ DATE_____ APPROVED BY_____ DATE_____

INSTRUCTIONS—Read Carefully

Each employe's ability and fitness in his PRESENT occupation or for promotion may be appraised with a reasonable degree of accuracy and uniformity, through this rating report. The rating requires the appraisal of an employe in terms of his ACTUAL PERFORMANCE. It is essential, therefore, that snap judgment be replaced by careful analysis. Please follow these instructions carefully:

1. Use your own independent judgment.
2. Disregard your general impression of the employe and concentrate on one factor at a time.
3. Study carefully the definitions given for each factor and the specifications for each degree.
4. When rating an employe, call to mind instances that are typical of his work and way of acting. Do not be influenced by UNUSUAL CASES which are not typical.
5. Make your rating with the utmost care and thought; be sure that it represents a fair and square opinion. DO NOT ALLOW PERSONAL FEELINGS TO GOVERN YOUR RATING.
6. After you have rated the employe on all six factors, write under the heading "General Comments" on the back, any additional information about the employe which you feel has not been covered by the rating report, but which is essential to a fair appraisal.
7. Read all four specifications for Factor No. 1. After you have determined which specification most nearly fits the employe, place an X in the small square over it. If the specification adequately fits the employe, place an X in the left square. If he does not quite measure up to the specification but is definitely better than the specification for the next lower degree, place an X in the right square. Repeat for each factor.

FACTOR	R-1	R-2	R-3	R-4	R-5	R-6	R-7	R-8
What Has He Done?	☐	☐	☐	☐	☐	☐	☐	☐
1 QUALITY OF WORK — THIS FACTOR APPRAISES THE EMPLOYE'S PERFORMANCE IN MEETING ESTABLISHED QUALITY STANDARDS.	DOES HE CONSISTENTLY DO AN EXCELLENT JOB? ARE REJECTS AND ERRORS VERY RARE?		DOES HE USUALLY DO A GOOD JOB? DOES HE SELDOM MAKE ERRORS?		IS HIS WORK USUALLY PASSABLE? MUST YOU SOMETIMES TELL HIM TO DO A BETTER JOB?		IS HE CARELESS? DOES HIS WORK ONLY GET BY? DOES HE OFTEN MAKE MISTAKES?	
2 QUANTITY OF WORK — THIS FACTOR APPRAISES THE EMPLOYE'S OUTPUT OF SATISFACTORY WORK.	☐	☐	☐	☐	☐	☐	☐	☐
	IS HIS OUTPUT UNUSUALLY HIGH? IS HE EXCEPTIONALLY FAST?		DOES HE USUALLY DO MORE THAN IS EXPECTED? IS HE FAST?		DOES HE TURN OUT THE REQUIRED AMOUNT OF WORK BUT SELDOM MORE?		IS HE SLOW? IS HIS OUTPUT FREQUENTLY BELOW THE REQUIRED AMOUNT?	
What Can He Do?	☐	☐	☐	☐	☐	☐	☐	☐
3 ADAPTABILITY — THIS FACTOR APPRAISES THE EMPLOYE'S ABILITY TO MEET CHANGED CONDITIONS AND THE EASE WITH WHICH HE LEARNS NEW DUTIES.	DOES HE LEARN NEW DUTIES AND MEET CHANGED CONDITIONS VERY QUICKLY AND EASILY?		CAN HE TURN FROM ONE TYPE OF WORK TO ANOTHER OR GRASP NEW IDEAS IF GIVEN A LITTLE TIME AND INSTRUCTION? DOES HE ADJUST HIMSELF TO NEW CONDITIONS WITH LITTLE DIFFICULTY?		IS HE A ROUTINE WORKER? DOES HE REQUIRE DETAILED INSTRUCTION ON NEW DUTIES AND METHODS?		IS HE SLOW TO LEARN, REQUIRING REPEATED INSTRUCTIONS? DOES HE HAVE GREAT DIFFICULTY IN ADJUSTING HIMSELF TO NEW WORK?	
4 JOB KNOWLEDGE — THIS FACTOR APPRAISES HOW WELL THE EMPLOYE KNOWS HIS JOB.	☐	☐	☐	☐	☐	☐	☐	☐
	IS HE AN EXPERT ON HIS JOB? DOES HE MAKE THE MOST OF HIS KNOWLEDGE AND EXPERIENCE? IS HE A SELF-STARTER?		IS HE WELL INFORMED ON HIS JOB AND RELATED WORK, RARELY NEEDING ASSISTANCE AND INSTRUCTION BUT ASKING FOR THEM WHEN IT WILL SAVE TIME?		DOES HE KNOW HIS JOB FAIRLY WELL? DOES HE REGULARLY REQUIRE SUPERVISION AND INSTRUCTION?		IS HIS KNOWLEDGE OF HIS JOB LIMITED? DOES HE SHOW LITTLE DESIRE OR ABILITY TO IMPROVE HIMSELF?	
Can You Rely on Him?	☐	☐	☐	☐	☐	☐	☐	☐
5 DEPENDABILITY — THIS FACTOR APPRAISES YOUR CONFIDENCE IN THE EMPLOYE TO CARRY OUT ALL INSTRUCTIONS CONSCIENTIOUSLY.	WHEN YOU GIVE HIM A JOB TO DO, HAVE YOU THE UTMOST CONFIDENCE THAT YOU WILL GET WHAT YOU WANT WHEN YOU WANT IT?		DOES HE FOLLOW INSTRUCTIONS AND DO WHAT YOU EXPECT HIM TO DO WITH LITTLE FOLLOW UP?		DOES HE GENERALLY FOLLOW INSTRUCTIONS BUT OCCASIONALLY NEED FOLLOWING UP?		DOES HE REQUIRE FREQUENT FOLLOW UP, EVEN ON ROUTINE DUTIES?	
6 ATTITUDE — THIS FACTOR APPRAISES THE EMPLOYE'S OPEN-MINDEDNESS, AND HIS WILLINGNESS TO COOPERATE IN CARRYING OUT SAFETY AND OTHER COMPANY POLICIES.	☐	☐	☐	☐	☐	☐	☐	☐
	IS HE AN EXCEPTIONALLY GOOD TEAM WORKER? DOES HE INVARIABLY GO OUT OF HIS WAY TO COOPERATE? IS HE ALWAYS READY TO TRY OUT NEW IDEAS?		DOES HE MEET OTHERS HALF WAY AND GO OUT OF HIS WAY TO COOPERATE? IS HE USUALLY READY TO TRY OUT NEW IDEAS?		DOES HE USUALLY COOPERATE, BUT WITH SOME RELUCTANCE TO ACCEPT SUGGESTIONS AND TRY OUT NEW IDEAS?		DOES HE COOPERATE ONLY WHEN HE HAS TO? IS HE UNWILLING TO TRY OUT NEW IDEAS? DOES HE HAVE LITTLE INTEREST IN HIS JOB?	

(OVER)

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Figure 5. Report used by foreman to rate each man on the basis of what he has done, what he can do, whether he can be relied on

GENERAL COMMENTS

1. IN YOUR OPINION, IS THIS EMPLOYE PERFORMING THE TASK BEST SUITED TO HIS ABILITY? IF NOT, WHAT SORT OF WORK SHOULD HE BE DOING?

2. WHAT ESPECIALLY DESIRABLE GOOD TRAITS DOES HE HAVE?

3. ALONG WHAT LINES DO YOU FEEL THAT HE NEEDS TO IMPROVE HIMSELF?

4. IS HE DOING ANYTHING TO IMPROVE HIMSELF?

5. WHAT IS HIS RECORD AND ATTITUDE AS TO SAFETY?

6. WRITE HERE ANY ADDITIONAL COMMENTS, GOOD OR BAD, WHICH YOU FEEL HAVE NOT BEEN COVERED.

Figure 5 (reverse). The other side of the employee rating report affords the foreman plenty of room to make general comments

5. Decision should be made as to the number of times a year employees are to be rated. Ratings should be made not less than twice a year. Too frequent ratings should, however, be avoided. The question may come up as to whether all employees are to be rated at the same time or whether departments are to be staggered. The size of the plant will largely decide this.

The following procedure is recommended in applying the rating plan:

1. Furnish each department foreman with a set of rating sheets for his employees. Type or addressograph each employee's name and number on a rating sheet. Tell the foreman when the ratings are to be returned.

2. Instruct each department foreman to give assistant foremen an opportunity to take part in rating those directly under them.

3. Have the foreman rate all employees in his department, keeping in mind the instructions given later.

4. After the foreman has rated every man, have him make up a summary of their ratings (Figure 6). Have the foreman check *all the quality ratings of his men*, to be sure he has been consistent in rating them all on quality. Then have him check *all the ratings on quantity on all the men.* Do this for each of the remaining factors. The purpose of this is to help the foreman *be more consistent by considering the ratings for each factor on all his men, thus checking his previous judgment when he rated each man on all the factors.*

5. Ratings by foremen should be reviewed and checked by the superintendent or industrial relations manager. Only after this has been done thoroughly and carefully should any attempt be made to use the data. Unless the ratings are checked as described in 4, there are bound to be inconsistencies. It is just as essential to secure consistency in employee rating between departments as it is in job rating. A Group 1 man in one department should mean the same thing as in another. This means that top management must help each foreman to get the same idea or concept, for example, of what R-1 in Quality or R-4 in Quantity means.

6. Each employee's rating should be kept confidential. Under no circumstances should one employee be shown another's rating.

7. Raters should not have access to previous ratings when re-rating.

8. A simple card record should be set up for each employee to which the successive ratings may be posted.

If a company applies the Metal Trades employee rating plan and the results show that all employees have been rated between 75 and 100 points with a plant average of say 88, it can safely conclude that a superficial job has been done and the results are of no value. If this should happen there is only one thing to do, destroy the ratings and do it over, making sure the foremen have a clearer understanding of the yardstick.

Where the rating plan has been properly applied, a distribution something like the following will usually be found:

Group 1	3 to 5%
Group 2	8 to 12%
Group 3	65 to 70%
Group 4	10 to 15%
Group 5	3 to 5%

These percentages are approximate only. The essential point is that, under normal conditions, about two-thirds of the working force will be found to fall in Group 3.

The primary purpose of employee

HOW TO RATE EMPLOYEES

Instructions for Supervisors

1. Study the rating sheet carefully so that you understand exactly on what you are going to rate your men. Read instructions on sheet.

2. If you have several persons on the same job or occupation or class of work, start with such a job. For example, suppose you have eight arc welders but you consider there is a difference in the class of work the men are called on to do or even can do. Suppose you have rated the job and concluded you had Class A and Class C Arc Welding, with four men in each class. How do the Class A Welders compare? By rating the four men, it is possible to get a better picture of individual performances.

3. Select one of the Class A Welders: (a) Take his rating sheet and rate him carefully on each one of the six factors, placing an *X* in the columns which you believe best describe him; (b) start at the right hand with the lowest degree for each factor and read across to the left until you find the description you think best fits the man; (c) be fair and do not jump at conclusions; (d) weigh the individual's performance as to quality of work, quantity, adaptability, job knowledge, dependability, attitude; (e) *make only one check mark on each of the six factors.*

4. When you have rated this man, take each of the other three Class A Welders and do the same thing. Use the first rating as a yardstick and compare these men with it. Ask yourself should each man be rated the same, higher, or lower than the first man, on quality, for example, and if more or less, which description best fits.

5. Take the Class C Welders and do the same thing. Remember, in rating men, you are rating *the performance of the individual on his own job.* On this basis, a man may qualify for Group 1 or 2 regardless of whether his job is skilled, semi-skilled, or unskilled. For example, you may have a Group 1 man in your Class A Arc Welders, and you may have a Group 1 man in your Class C Arc Welders. This does not mean the abilities of both men are the same or even comparable, or that both should receive the same rate. It simply means *each of the two men has the highest individual rating on his own job.*

6. When you have rated all men in your department (calling in assistant foremen if there are any), check over all your ratings to see that you have been consistent. The best way to do this is to make up a simple summary for all your men such as is shown on page 70.

7. Next, apply the number of points to each employee rating. It is optional whether the foreman applies the point ratings and adds these up or whether it is done by someone else, as long as the rating data are kept confidential. Where the department is small, it is preferable to have the foreman actually work up the ratings. Foremen should not, however, refer to the point values when rating employees.

8. Finally, each department foreman should have an opportunity to sit down with his superior and review all the ratings of his men. There are two reasons for this: First, to make sure that all foremen have the same idea or standard as to what each degree on the several factors means, so they will all be rating their men on the same basis; second, to give the foreman a chance to discuss his men with top management.

rating should be to raise the standards of performance of the working force by enlisting the interest of those employes who fall in Groups 3, 4, and 5 to improve themselves.

The uses that can be made of employee ratings are pointed out on page 66. No specific comments are necessary on any of them other than an explanation of how individual ratings may be used in adjusting hourly or base rates.

Where the Metal Trades Job Rating Plan has been applied, it has been suggested that a rate range or wage band be established for each job, based on the labor grade in which the job falls. For example, let us assume the job of Engine Lathe Operator—A. The job has been rated at 316 points and falls in Grade 3. The company has decided that base rates on Grade 3 jobs shall range from 80 to 90¢ per hour. This has been determined by *rating the job.* As a rule, such rate ranges should not exceed 10 to 15 per cent. For example, if 60¢ is the minimum, then the rate range for the grade should not exceed 6 to 10¢, or 66 or 70¢ as the maximum.

Assume there are six men in that job classification. How can their individual day or base rates be fairly appraised or set? By rating the men themselves.

The following method for setting day work or base rates, on the basis of employee ratings, is suggested. It presupposes the policy of varying individual day or base rates on the same job.

1. Any Group 1 employee should be entitled to receive the maximum rate specified for that job. In the above illustration, this would be 90¢.

2. Any Group 2 employee should be entitled to receive three-fourths of the difference between the maximum and minimum rates in the rate range. In the example above, the spread in the rate range is 10¢. A Group 2 man on the "A" Engine Lathe job would then be entitled to a base rate of 80¢ plus three-fourths of 10¢ or 87½¢.

3. Any Group 3 employee should be entitled to receive one-half of the difference in the spread.

4. Any Group 4 employee should be entitled to receive one-fourth of the difference in the spread.

5. Any Group 5 employee would be entitled to receive only the minimum rate specified for the job.

Where the employee ratings are to be used in considering promotions, it hardly need be pointed out that other factors should be considered, depending on the requirements of the job to which promotion is to be made.

EMPLOYEE RATING SUMMARY

	QUALITY	QUANTITY	ADAPTABILITY	JOB KNOWLEDGE	DEPENDABILITY	ATTITUDE
L. M. Adams	2	6	1	1	2	3
O. Bartlett	3	1	2	3	6	3
J. P. Brown	1	7	5	2	1	1
M. P. Burke	5	5	3	6	5	2
D. A. Chapman	8	5	1	1	5	2

Figure 6. Summary sheet by which the foreman checks the ratings of all his men

It is, of course, necessary to make sure that all persons, who are to use the employee rating plan, have the same understanding of what each degree means on each factor.

The rater should therefore study the following explanations of the quality and quantity factors, and how they are to be used. The other four factors require no explanation.

Quality of Work

When rating for quality, ask yourself only to what degree the man meets the quality standards prescribed for his own job.

It is essential to realize:

1. That quality standards themselves are different on different jobs. For example, external grinding may require very close tolerances (perhaps 0.0005 inch) and a fine finish, both of which are largely within the control of the grinder himself. On the other hand, on a punch press where the job is set up by a set-up man, the quality standards are entirely different and within the control of the operator only to a limited degree. This difference in the job requirements is appraised in *rating the jobs* and is not to be considered in rating the men.

2. Therefore, it is possible to rate both an external grinder and a punch press operator R-1 or R-2 on quality if the quality of their work meets the specification for R-1 or R-2, as shown on the rating sheet.

3. Where scrap records are kept, they should be consulted in rating for quality. Quality may, however, only be just passable, even if scrap is low.

Quantity of Work

Two situations arise in rating an employee for quantity of work:

1. Jobs where output is controlled by the individual.

2. Group work where the efforts of the group control output or where the rate of production is predetermined, as on line assembly.

The rating is clear in the first instance. Where the job is on individual incentive, the average hourly earnings of the man or his percentage efficiency is the best test of quantity. Such records should be used as a basis for rating.

On the other hand, on a line assembly operation with predetermined outputs per hour, it would not be fair to rate the group R-5—which is "turn out the required amount of work" if in fact "the required amount of work" would fairly rate R-2 or R-3 to make it comparable with other jobs in the plant.

A widely used policy in connection with lay-offs and rehiring is as follows. In case of increase or decrease of the working force the following factors shall be considered:

1. Knowledge, skill, ability, efficiency.
2. Physical fitness.
3. Family status, dependents.
4. Place of residence.

Where these factors are relatively equal, then length of service shall govern.

It is, of course, obvious that the only fair way to appraise the factors under 1, which deal with individual performance, is by an employee rating plan. Factors 2, 3, 4, and length of service itself, are *matters of fact* and the answers are readily obtained. Knowledge, skill, ability, and efficiency are of necessity *matters of opinion* and the answers are always relative. Under such a policy, it thus becomes absolutely essential to use a qualitative rating, in terms of concrete performance factors. The Metal Trades employee rating plan, properly applied, can determine fair and dependable answers to Factor 1.

In conclusion it should again be emphasized that the NMTA employee rating plan, like the job rating plan described in Part One, may be used "as is" or with slight modifications by any plant in any industry. Both plans are simple and easily understood. Both are invaluable working tools for those plant operating men who have discovered that industrial relations is industry's No. 1 job today.

MAINTENANCE SERVICES

SELECTION • INSTALLATION • INSPECTION • UPKEEP • ORGANIZATION

People and machines engaged in production must be supplied with buildings and with many services, such as electrical and mechanical power, heat, light, water, sanitary facilities, air conditioning, ventilation, dust collection, protection, communication, housekeeping. Providing these services and keeping them in condition for efficient production constitutes the Maintenance Service function. ¶ Practically every activity of maintenance service has to do with the Selection, Installation, Inspection, or Upkeep of equipment. For the benefit of FACTORY'S readers these classifications are carried at the top of the first page of each major article, and check marks are set against the classifications to which the articles belong. A fifth classification — Organization — is checked when the article deals with maintenance department organization and direction

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FACTORY MANAGEMENT AND MAINTENANCE

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EDITORIALS

L. C. MORROW . . . *Editor*

Maintenance Must Be Prepared for All Emergencies

EFFECTS OF THE WAR on American industry cannot be foretold in much detail. There can be no doubt, however, that if hostilities continue for any considerable length of time they will exert weighty influence.

There seems to be little doubt that inability of the nations at war to handle their foreign trade will eventually result in increased buying of American goods. These nations, and others too, will call upon us for supplies and materials in greater amounts than heretofore. All this means that industry may have to meet considerably heavier demands for its products.

Upon maintenance falls much of the task of putting and keeping industry in condition to meet whatever demands are made on it. In discharging this important duty, a thoroughgoing check-up of all equipment for which maintenance is responsible will be in order:

Take advantage of the mild autumn weather to put exterior building surfaces, yard structures, and grounds in first-class condition. Painting and repair work can easily be done now; later they will be difficult.

On the inside, look into the condition of floors and stairways. Check the adequacy and efficiency of building heating equipment. Don't forget that light-colored paint on walls and ceilings may greatly increase the effectiveness of the lighting system. The latter itself can well be the subject of a study to determine whether it is up to present-day standards.

Make sure that sanitary facilities are of suitable character, and adequate for increased personnel.

It is possible that production requirements will demand changes in layouts and the addition of new machines. Under these circumstances it is vitally important that the electrical distribution system have ample reserve capacity and be designed to permit changes in the location of power-using equipment with the minimum of effort. Insulation must be in good condition. Protective devices must by all means have adequate interrupting capacity for the electric power supply.

If power factor is low, correction may be expected to release conductor capacity, reduce voltage drop, and lighten the burden on the power company's lines. Always important, these items are likely to be of increasing consequences as the demand for power goes up.

Carefully check all motors, controls, protective, and transforming equipment for condition and load. See also that an adequate stock of spare units and parts is available for immediate use.

Investigate the condition and suitability from the service standpoint of all power drives and materials handling equipment.

Likelihood of fires increases as plant activity goes up. There is also the possibility that sabotage later on may take the form of incendiary fires. Therefore, examine all firefighting equipment and alarm systems, and replace or repair any items not up to standard. Study also the advisability of adding to present equipment, or supplementing it with other types.

Study the maintenance organization, strengthen weak spots, make sure that the work is properly scheduled and handled efficiently.

At the moment, maintenance is not working under emergency conditions, but there is no certainty they will not come. Far-sighted executives will therefore prepare now to meet any eventuality.

More for Eye Protection Means Less for Compensation

EYE INJURY CASES settled in Wisconsin during 1938 were only 3.5 per cent of all injuries, but the 725 cases cost $426,376 in indemnities and medical aid. That amount represents 9.07 per cent of the benefits paid for all injuries. Specifically, the average benefits per eye injury amounted to $588, whereas $230 was the average amount for all injuries. These figures have recently been released in a report issued by the Industrial Commission of Wisconsin.

A measure of the disabling effect of eye injuries, as compared with other types, is found in the average number of days loss of time. Average loss per eye injury was 190 days, whereas the worker who injured some other part of the body lost only 97 days—barely more than half as much.

Much progress has been made in awakening both workers and management to the necessity of adequately protecting the precious organs of sight. It is equally true that much remains to be done in instituting safety campaigns and enforcing injury-preventive measures.

The sum of $426,376 would buy a great many goggles or shields, pay for much safety instruction and supervision. And there is no telling how many priceless eyes it might save from impairment or total destruction.

Capacitor Motors—When and Where

Individual characteristics of available designs must be kept in mind, to make certain of picking the right one

E. P. CODLING
Motor Engineer
Westinghouse Electric & Manufacturing Company
Lima, Ohio

FOR MANY YEARS practically the only single-phase motor available above 1/3 horsepower was some variation of the repulsion motor. All these motors have commutators, brushes, and wound armatures. Some have centrifugal short-circuiters and brush-lifting devices. These parts have been so perfected that little trouble is experienced with them; nevertheless, fundamentally they cannot be made to withstand the same severe service under unfavorable conditions that the squirrel-cage rotor will.

As capacitors, developed originally for the radio industry, became lower in price and of satisfactory reliability, it became possible to manufacture capacitor motors with characteristics suitable for many applications, at a cost more comparable with that of the repulsion motor. They are constantly being improved. The capacitors and associated apparatus make these motors more complicated than the polyphase type, but the simple squirrel-cage construction tends to give more freedom from trouble and require less maintenance than the repulsion motor.

Essentially a Two-Phase Motor

The capacitor motor consists essentially of a two-phase motor (the windings may not be identical) with capacitors and associated apparatus to convert the single-phase power to two-phase. Capacitors alone will not create two-phase power, but when properly selected for a given motor they will, in conjunction with the motor, make this transformation.

One phase winding of the motor, called the main phase, is connected directly to the single-phase power line. The second phase winding, called the capacitor phase, is connected in series with the capacitor, the two being connected across the line. Current drawn by the capacitor phase is substantially constant, irrespective of load or motor speed. Its value depends upon the microfarad capacity of the condenser and the constants of the motor.

If the size of the capacitor is such that the current drawn equals that of a corresponding two-phase motor at full load, performance at full load will be comparable with that of the two-phase motor. At light loads and overloads the performance will be inferior to that of the two-phase motor, but satisfactory. At standstill, however, the capacitor-phase current will also correspond to the full-load current of the two-phase motor, instead of the locked current.

Since the starting torque is proportional to the product of the current in the two phases it will be greatly reduced. Assuming that the two-phase motor had 500 per cent starting current and 150 per cent starting torque, the capacitor motor would have a starting torque of,

$[(100 \times 500) \div 500^2] \times 150 = 30$ per cent of full load

This value of starting torque is too low for any except the easiest starting

Graduation from East Side High School, Cincinnati, and a degree in electrical engineering from the University of Cincinnati (1929) led Eldred P. Codling to a position as motor design engineer with the Westinghouse Electric & Manufacturing Company. Located in East Pittsburgh for the past nine years, he shifted to the Westinghouse small motor division at Lima in January of this year. Besides being affiliated with the A.I.E.E., Codling has the honor of membership in Tau Beta Pi and Eta Kappa Nu, honorary engineering fraternities. Fishing is his idea of fun

loads. Actually a motor of this type (called a single-value capacitor motor) is employed only with direct-connected blowers and fans. Its use is limited mostly to the fractional-horsepower sizes. No control or centrifugal switch is required.

If the value of capacity is so chosen as to give locked-rotor current in the capacitor phase equal to the locked-rotor current of the two-phase motor, the starting torque of the capacitor motor will be similar to that of the other motor. But at full load the capacitor-phase current would remain the same; therefore the efficiency would be greatly reduced and overheating would occur almost as rapidly as though the motor were stalled. To prevent this condition when such a capacitor is used, the capacitor phase is opened as soon as the motor reaches somewhere near full speed. After the circuit is opened the motor operates as a straight single-phase motor. Figure 1 shows characteristic curves of such a motor.

Since the capacitor phase is used only at the start it may be of much smaller wire than the main phase, thus providing more space for the main-phase winding. Actually in practice the main phase usually occupies about two-thirds of the slot space and the capacitor phase one-third. The capacitor phase has about four times the resistance of the main phase. This type of motor is known as a capacitor-start motor. It is the most common type.

These two types of capacitor motors may be combined into one, thereby obtaining many of the good features of each. One value of capacitance chosen for good running performance is permanently connected in series with the capacitor phase. This capacitor must be designed for continuous operation. A second capacitor connected in parallel with the first is of such value that the combined microfarad rating gives the capacity required for good starting torque. See Figure 2. This second capacitor need be suitable only for intermittent operation, because it is cut out of the circuit as soon as the motor is started.

A more common way of obtaining these two values of capacitance is to use a combination of capacitor and transformer, as shown in Figure 3. The effective capacitance on the primary side of the transformer is raised by increasing the voltage applied to the capacitor. Suitable taps are provided on the transformer to apply approximately double voltage on the capacitor, which gives the effect of four times the microfarad rating. It has been found that continuous-rated capacitors in general are suitable for operating at this overvoltage intermittently, for starting.

Two-Value Capacitor Motors

This arrangement usually has been found to be more economical than the use of two capacitors without transformers. It is particularly advantageous in that it provides a simple means of operating the capacitor at its full voltage rating for continuous service even on low-voltage (110-volt) motors.

This type of motor is called a two-value capacitor motor. It is now commonly used in the integral-horsepower sizes, but only infrequently in the fractional-horsepower sizes.

The capacitors used with these mo-

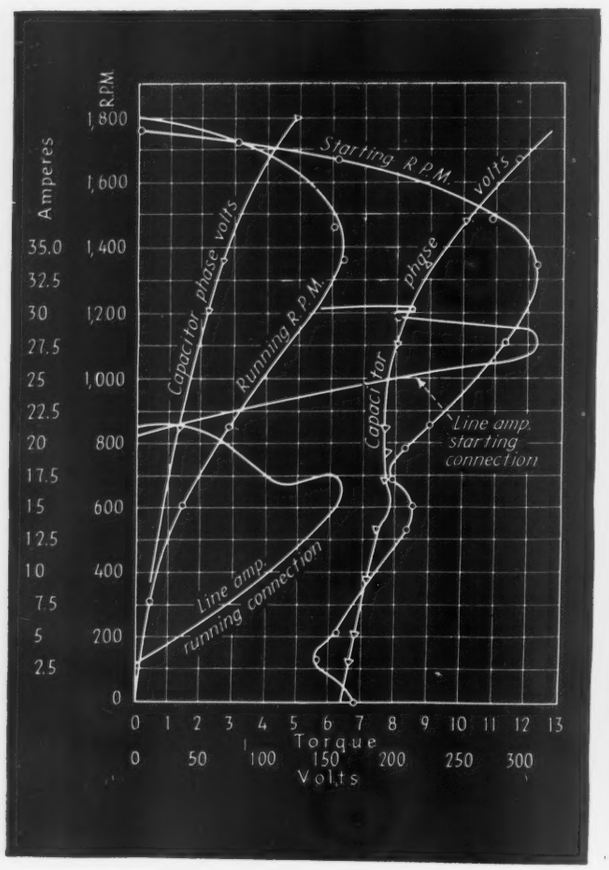


Figure 1. These are all characteristic curves of a 1-hp., four-pole, 220-volt, 60-cycle, capacitor start—induction run motor

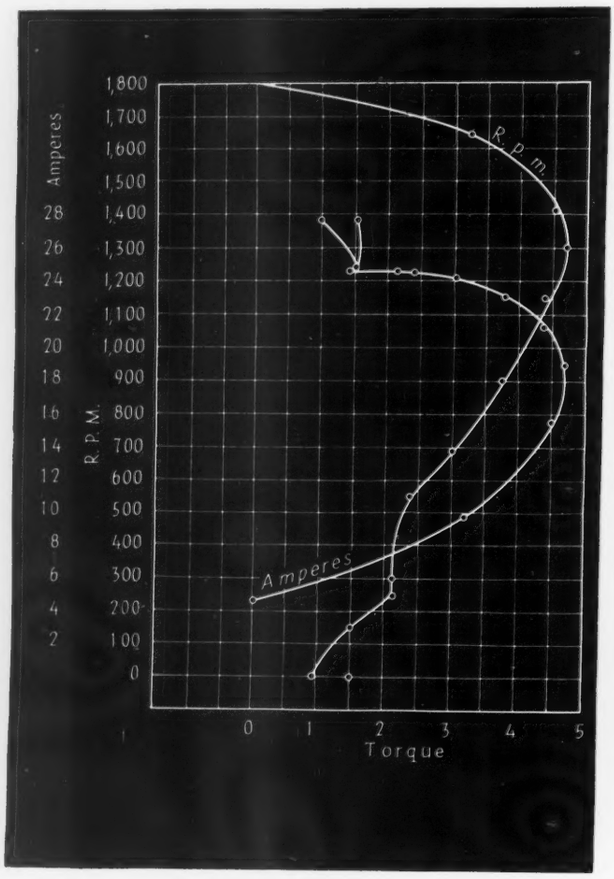


Figure 2. Characteristic curves of a 1-hp., four-pole, 110-volt, 60-cycle, capacitor start and run motor have this appearance

tors are of two general types: electrolytic and oil or synthetic fluid. Electrolytic capacitors have high dielectric losses and are therefore suited best for intermittent duty only. For such service they have the greatest microfarad rating for a given size and cost. It is inherent in their design that they are suitable only for low voltages, approximately 150 volts maximum. Some types can be connected in series for higher voltages, but in general this is not considered good practice because of the unequal division of the voltage which may occur as rating of units varies.

Temperature Affects Rating

Most of them are applied for starting service either on 110-volt motors or 220-volt motors of special design, whereby the voltage across the capacitor is kept low. The thin metal cover of these capacitor elements must be insulated from the windings of the motor and from ground because it may come in contact with the electrolyte and become electrically live.

Oil- or synthetic-fluid-filled capacitors are suitable for continuous operation at 220 volts and higher, depending upon the thickness of the dielectric. Lower-voltage units are impractical, because of the thin dielectric required. The most economical units for use with capacitor motors in general are rated 330 or 440 volts. These voltages may be approximately doubled for intermittent or starting service.

The microfarad rating of many of these capacitors is effected by temperature. Special care must be taken with those applications where the temperature may go down below 20 degrees F. to make certain that the capacitor rating is sufficiently large at these low temperatures to give satisfactory starting torque. The rating may be reduced to 80 per cent of its normal value below this temperature. The full rating is again obtained, however, as soon as the normal temperature is restored by operation or in some other suitable manner.

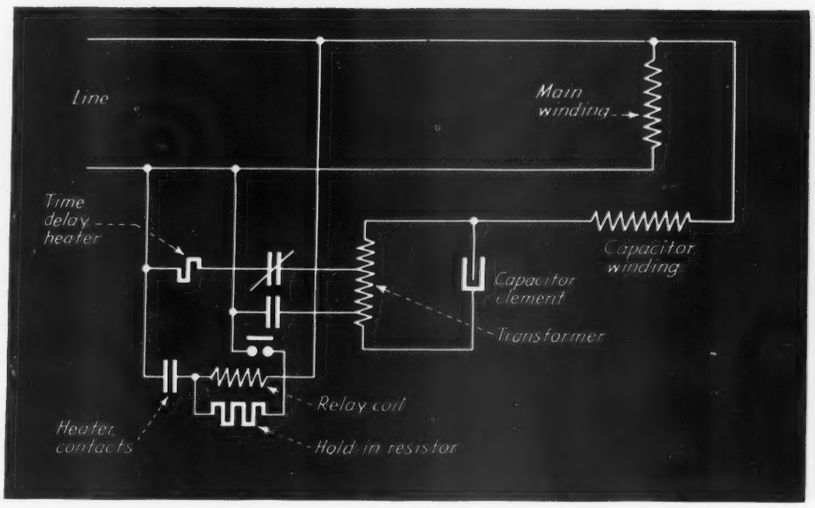


Figure 3. This diagram shows typical connections of an integral-size, capacitor start—capacitor run (two-value) motor that is using heater-type time delay control

It is unfortunate that this reduced capacity occurs at low temperatures where, because of the increased viscosity of lubricants, the starting load may be greatest.

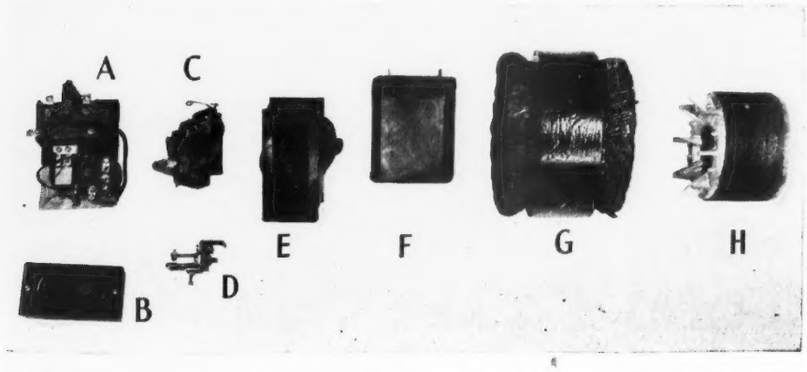
As previously stated, transformers are frequently used with continuous-rated capacitors both to increase the applied voltage for starting and to provide for operation of the capacitor at the most economical point. When transformers are used the effective capacitance measured on the primary is increased by the square of the voltage ratio. They are normally auto-transformers since with the small voltage ratio commonly used this type is the most economical.

Control devices used with these motors to open the capacitor circuit or change its connections vary considerably in design, but are of two general types: those based on time delay, and those which operate as a function of the motor speed. The time-delay controls use either dashpots, heaters, or some of the other common means of obtaining a time delay of from 1 to 10 seconds to permit the motor to accelerate, after which relays function to change to the running connection.

Their principal advantage is the simplicity of application, and the fact that the allowed starting time is almost independent of voltage variation. Principal disadvantages are: the time of operation is not dependent upon the actual time of acceleration, which may vary with the starting load; the motor may be permitted to accelerate to full speed, where the voltage across the capacitor may be slightly greater than at standstill; on repeated operation the time delay requires time to reset.

Controls whose operation depends on the speed of the motor are centrifugal devices, usually mounted inside the motor itself, or a relay operating upon the variation in the main-phase current or the voltage across either the capacitor phase or the capacitor phase and a part of the transformer. In most designs this current decreases, or the voltage increases, as the motor reaches approximately 80 per cent of full speed. This method of control requires very careful application of the relay to each individual motor design. The speed at which the relay will function is affected by line voltage variations, which must be considered.

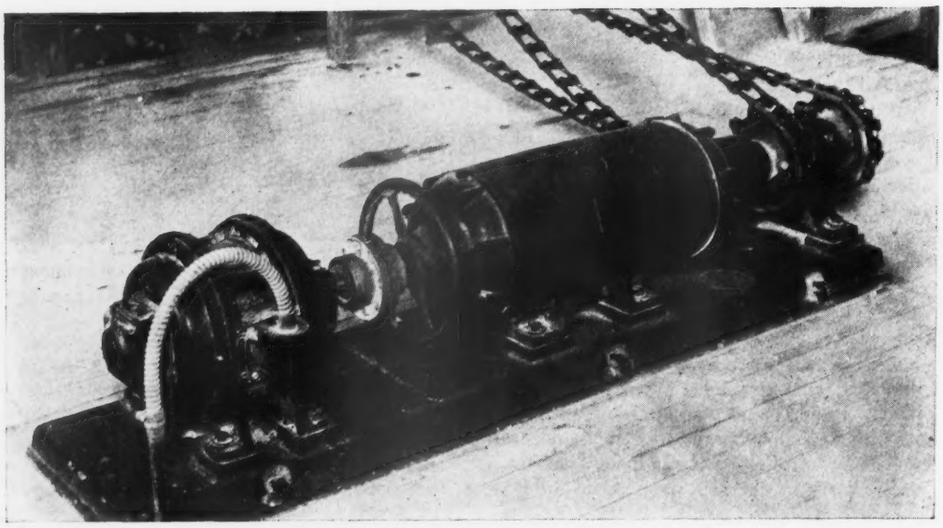
(A succeeding article, to be published in an early issue, will discuss the application and maintenance of capacitor motors. Ed.)



Auxiliary equipment, parts of capacitor start-capacitor run motor are: *A*, magnetic starter; *B*, pushbutton; *C*, relay; *D*, heater; *E*, transformer; *F*, capacitor; *G*, stator; *H*, rotor

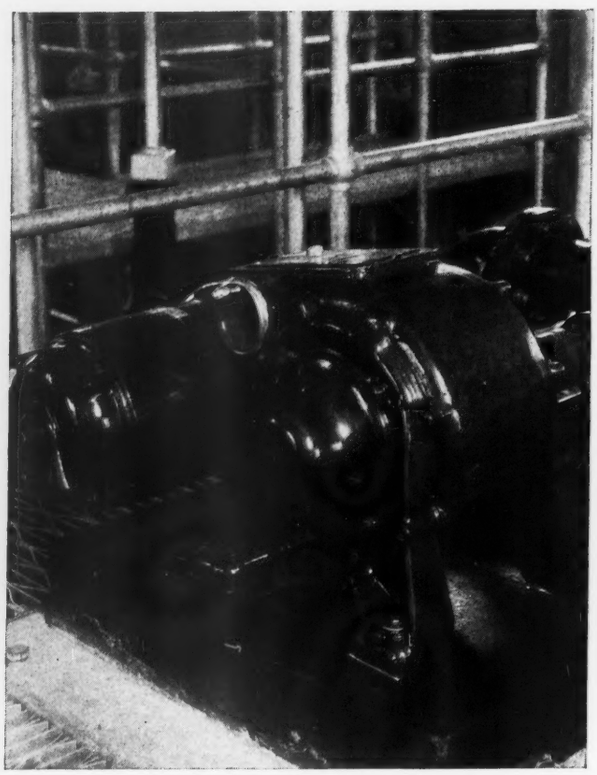
Just the Speed You Want

With mechanical v.s. drives

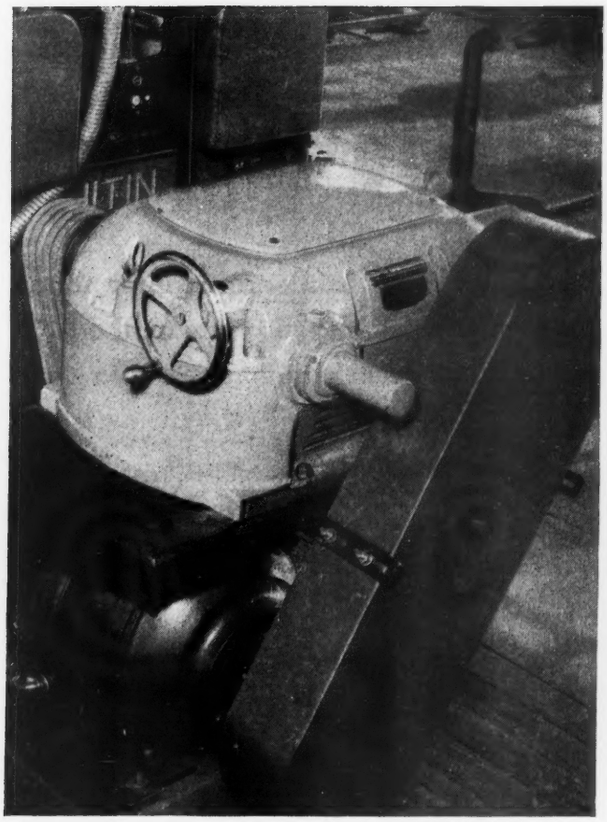


A variable-speed transmission (Stephens-Adamson) controls the kiln feeder in a paint pigment plant

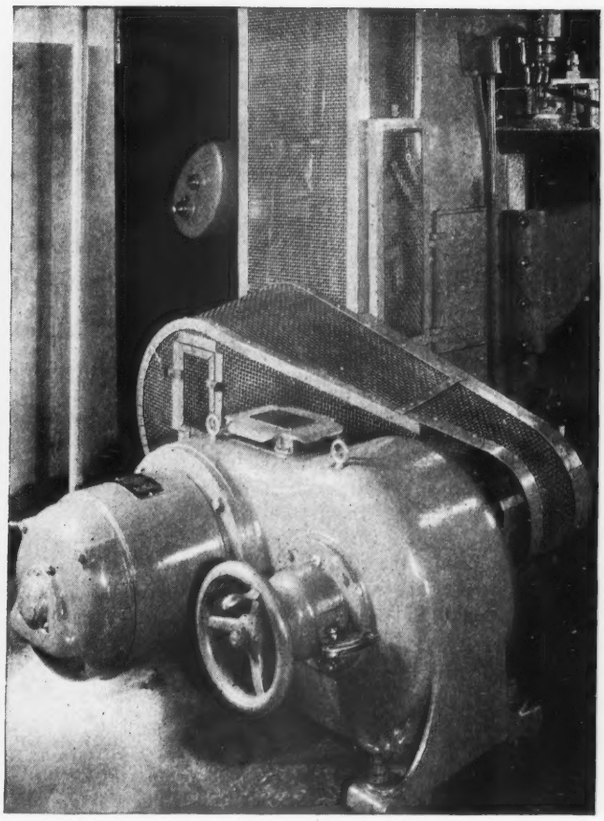
Speed of a brake block grinder must be adjusted to the size of block. Here it's done with motorized (Reeves) v.s. transmission



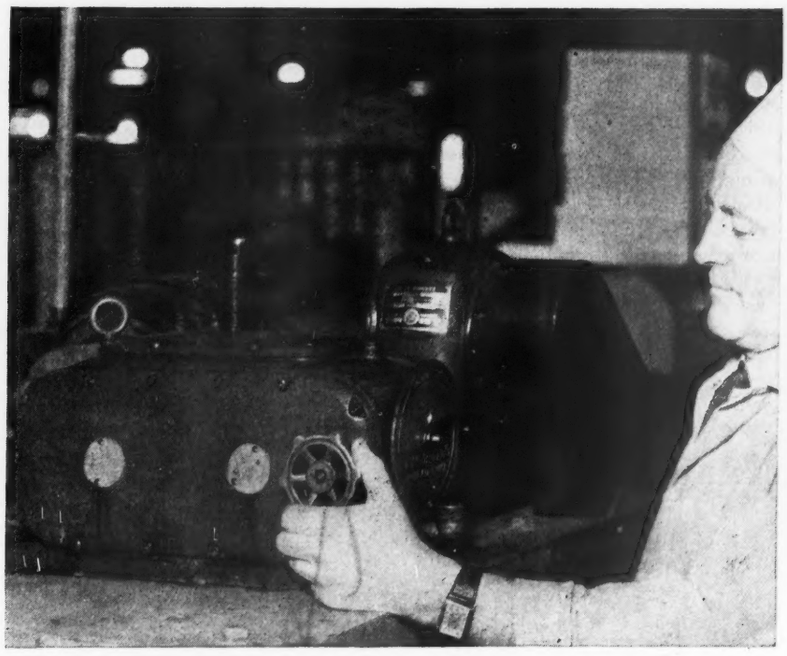
Driving a pump, this 3-hp. motorized v.s. transmission (Sterling) makes possible a range of 900 to 1,300 revolutions per minute



Ability to vary speed of spinning frame driven by speed changer unit (Allis-Chalmers) raises output, gives more uniform product



A 5-hp. motorized variable-speed drive (U. S. Motors) permits the operator of a milling machine to select the best cutting speed



In a candy factory the cooling conveyor is driven between 7½ and 30 feet per minute by a variable-speed unit (Link-Belt), to synchronize it with the enrobing conveyor

We Put It Up to 64 Flowmeters

They give all production and maintenance information needed in order to detect leaks and improve methods, in effect put executive supervision of plant on a 24-hour basis

JOHN C. KUHNS

Power Plant Engineer, A. E. Staley Manufacturing Company, Decatur, Ill.

NOT LONG AGO one of our production executives stopped in a manufacturing department and called the foreman aside. "Some of your men are hurrying up their jobs too fast in the late afternoon and getting finished so they can wash up before quitting time," he stated. "It is bound to cut down yields in the next process. Check on it this afternoon and let me know what you find out."

Next morning the foreman telephoned. "That's just what was happening," he admitted. "I caught three of 'em at it yesterday. Where in the world did you find it out?"

"Over in the power house," chuckled the boss. "You'd be surprised what you can find out about process departments over there!"

Located at Strategic Points

What actually had flagged his attention was a look at the flowmeter dials which fill a large panelboard in the power plant. These dials register the measurements of flowmeters scattered at strategic points throughout our plant. They are there primarily for the conventional purpose for which flowmeters are used—to measure steam and water consumption for cost accounting purposes, or to disclose the efficiency of steam and power generating equipment. But they incidentally disclose a great deal of information that enables us to catch leaks and improve methods.

Practically every one of our management executives whose work takes him to the power house, either frequently or occasionally, makes a practice of stopping at the flowmeter board to see what he can see. Here an experienced eye sifts out all manner of facts that can be converted into profits.

Take the incident of the workers who were crowding an hour's work into 40 minutes so that they could wash up and go home with the first note of the quitting whistle. The production executive who detected it was standing at the panelboard examining the chart lines when his eye caught an irregularity in the pattern. About an hour before the change of shifts the water consumption of one department rose to a level slightly above that for any other period of the day. Then it fell off below normal in half or three-quarters of an hour. The process carried on in that department requires a good deal of water. The water is run into machines along with cereal material to bring it to the proper consistency.

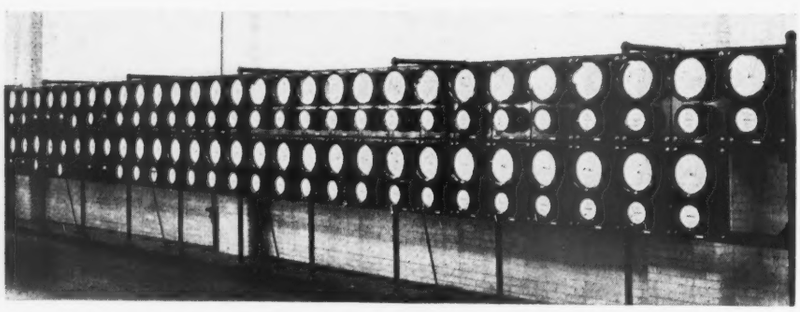
Since the mixing is done inside closed machinery the operator of a machine can easily increase the charge of grain, then thin it out with an extra slug of water and pass it along in a hurry. No doubt the worker who made this epochal discovery told a few of his best friends. So many started the practice that the variation in water consumption showed on the flowmeter chart. To an executive who knows the ways of the world, the dips and bumps on the chart told the story as clearly as though he had watched the men controlling the charges and turning the valves.

But lest this example give the idea that we use the flowmeter board as a super-spy, let's cite another department. Here in the process of making stock feed there is mixed with dry material a liquid which is a concentrated solution of nourishing, soluble substances that are removed in previous processes. The process is continuous, and the soupy solution must be run into the mix at a uniform rate in order to produce a feed of standard formula.

Find It Invaluable

Frankly, we have an unusual amount of trouble with the flowmeter used here because the solution is sometimes lumpy and clogs the instrument. But despite these troubles, we find it invaluable. It happens that with this process it is very easy to get away from the desired standard, but by watching the flowmeter we can detect any substantial variation from the desired rate of mixing. Lacking instrument control, we might have to go to a batch method, which would raise costs beyond all possible limits.

The primary purpose of our big battery of flowmeters is cost determination. Routine for checking them and tabulating the readings is predicated upon this principle. But as we watch the graphs, we find occasional irregularities. We are always looking for excep-



From these flowmeters, located in A. E. Staley Manufacturing Company's power house, are obtained the wide variety of facts needed to keep the plant operating at top efficiency

tions. The chart that shows the ordinary pattern for that meter gets a quick, penciled initial and goes to the files. But the chart that shows a peak where there should be a valley, or a dip where the line should run level, starts an immediate investigation. Maybe the fluctuation is readily explainable—a machine had to be shut down, or a steam leak was permitted for an hour rather than shut down a key operation.

Big Annual Savings

More often, however, it turns out that the big jump in steam consumption since yesterday evening is the result of a safety valve stuck open; or that the big consumption of water by some department came about because a float valve on a 125-lb. water line wore down and failed to shut. No one has ever attempted to tabulate the number of maintenance jobs that are called to our prompt attention by a jagged irregularity on a flowmeter chart, or to translate into dollar savings the economies that follow correcting these breakdowns before the loss becomes serious. During the course of a year these savings probably are large enough to pay for the entire flowmeter installation.

So we have made this rule: When a pattern skips, find out what did it.

Flowmeters are added as we find a need for them. In fact, our panelboard contains 64 working meters with one already mounted and awaiting the time when we find a use for it. In addition, we have indicating flowmeters in many places where the operators can watch them and use them directly in process control.

Often, too, we put a recording flowmeter on a line temporarily as a test. We find that the steam consumption per pound of product is excessive and quickly ascertain whether the machine is defective or whether our method of operation is faulty. Then we correct the condition and cut the cost.

Our regular battery of recording flowmeters measures both high-pressure and low-pressure steam. Also, they measure raw, zeolite, and filtered water. Some are connected up for departmental measurements, others for larger units.

A meter department, located in the power house, is responsible for these units. This department changes the charts and takes the integrator readings daily. It assembles all readings and makes reports.

First, it makes a distribution report covering the charge in quantities, not in dollars, against every department in the plant for its steam and water. A copy of this report goes to the general superintendent for his information. Another copy goes to the cost department, which converts the report figures into dollars and records them. The file copy goes to the power department, and then to the meter department files.

Second, it draws up a power plant report showing daily totals of steam, electrical energy, and water production.

The flowmeter charts themselves are distributed where they can best be used. Some go to the laboratory, some to the plant superintendent, some to the superintendent of the oil refinery. All those pertaining to steam go to the power plant office. Looking over the charts is accepted as one of the first tasks in the daily routine. If a chart is normal, it gets no further attention. If it shows exceptions, these are promptly investigated for possible action.

Functions or purpose of a few of the 64 flowmeters are shown in the box. They are identified by number.

These examples will suffice to show how we go about getting big profits from the use of flowmeters. They are always on the job, constantly disclosing facts of importance that otherwise might be overlooked, such as showing a flow of steam into a department that is shut down, because bleeder valves have been left open. These meters give our management 24-hour supervision over a widespread plant, and are particularly valuable in checking the performance of shifts where personal supervision is necessarily at a minimum.

In effect, they enable all of our management executives to be at all places in the plant at every hour the clock around. Naturally, this pays a profit.

Flowmeters Check These Services

Meter No. 1

Feed water to main boiler room. It is checked against steam output to keep control of blowdowns

Meter No. 2

Filtered water to zeolite system. Shows total output of zeolite water; also when to backwash zeolite

Meter No. 3

Filtered water to glucose refinery. With high-pressure water, a defective float valve will lead to serious waste

Meter No. 4

Low-pressure exhaust steam to five buildings. Shows how steam is distributed. Power department gets credit for all process steam supplied

Meter No. 6

Filtered water to mill house. Important in process control

Meters Nos. 21, 22, 23

Steam to the three largest turbo-generators. Checks water ratio of turbines; also serves as part of system to meter total boiler house output

Meter No. 24

Live steam to air compressor. Helps to estimate total air production, and gives another sub-total for figuring total steam production

Meter No. 25

Total raw water pumped. Indicates need for checking big-consumption departments for waste

Meter No. 29

Zeolite water to heater. Difference between readings of this meter and No. 1 amount of exhaust steam condensed in heater, plus condensate returned. Gives percentage of makeup

Meter No. 31

Live steam to table house. An open reducing valve here can waste 12,000 to 15,000 pounds of steam per hour

Meter No. 35

Condenser water to sewer. Vapor from vacuum pans has to be condensed, and surface condenser warms filter water. Charts show need of checking to find out whether hot water is being run into sewer instead of into filter basin

Meter No. 40

Bone wash water. Helps control laboratory hold water for back-washing bone filters for syrup at proper temperature, and minimize consumption

Meter No. 42

Live steam to exhaust in tunnel. A vent to atmosphere on a 3-lb. line is set to exhaust above 3¼ pounds. If flowmeter shows that steam is feeding in, back-pressure system is checked to see that heads are not relieving at too low a pressure; if pressure is up the valves should not be feeding. This meter probably pays for the entire flowmeter installation every year

Meter No. 44

City water to cinder flush. Desired to use only downleg water from barometric condensers, on its way to sewer. Whenever meter shows consumption of city water an investigation is made

Meter No. 45

Exhaust steam to feed water heater. Gives check on flow to atmosphere through overhead exhaust

Meter No. 48

Heavy steep water. Helps to control quality of stock feed, as described

Maintenance Is a Builder

CHESTER F. HORNE

Factory Superintendent, Hygrade Lamp Division
Hygrade Sylvania Corporation, Salem, Mass.

YEARS OF EXPERIENCE have taught us that good housekeeping, which is only another word for maintenance, achieves the standing it deserves in the same way that quality does—by seeping from the top management downward into the factory organization.

Not only do we prefer a clean, well-kept plant and efficient, well-cared-for machinery and tools, but we have also found it is actually profitable to operate in this manner.

The psychological effect on employees of a well-maintained plant is inestimable. Their morale is bolstered; they work better, do more, are happier. We have found that these things are reflected in the quality and production we get. Not only do employees like to have their machines operating smoothly; they also like to see them looking well. For this reason we paint machines, wherever possible, with a special green paint pleasing to the eye.

Gardening pays no tangible profits, but we are sold on the value of landscaping our plant properties and maintaining hedges, shrubs, flowers, and lawns in fresh, green condition throughout the spring and summer. We dress up the parking space in the yard and have permanent stalls lined up so that, when completely filled, the parking area is a treat to the eye rather than an abortion. Employees are proud to point out the plant to their associates when driving by.

It would indeed be an old-fashioned superintendent who has not learned that keeping floors, aisles, and stairways swept clean of debris is a major activity in the prevention of accidents. The maintenance of good lighting by scheduled washings of bulbs and reflectors is another strictly observed procedure which contributes to employee comfort and safety.

The liberal and frequent use of paint has a freshening-up effect on a manufacturing department that seems to give workers a definite "lift"—purely psychological, of course, but we've seen it happen again and again. It really becomes a better, more alert, more efficient department.

So sold are we on the idea of a generous investment in painting that we keep men on the payroll the year around who do nothing but miscellaneous painting of one sort or another. This is only on small jobs and does not include major jobs where outside painting contractors are called in.

Our experience shows that the cleanliness, orderliness, attention to details, and "fussiness" applied to maintenance are communicated to the workers in the various departments, and they become more orderly, more accurate, more enthusiastic workers, with a pride in the quality of their work. It all adds up to better work, better quality, lower maintenance costs.

A Regular Gold Mine

The benefits accruing from good housekeeping represent, to my mind, a gold mine, full of overlooked potentialities which can make rich contributions to all phases of manufacturing. These potential benefits are sometimes overlooked because no routine cost statements, quality reports, or safety records on this activity are delivered to the superintendent's desk to supply tangible evidence of its value.

Touching, in its far-reaching effect, all departments of manufacturing, but confined to none, the responsibility for this important activity rests squarely on the shoulders of the superintendent. His recognition of it as a major maintenance function, and his determination to keep it alive in the minds of the foremen will elevate good housekeeping to its proper importance as an essential function of maintenance.

Maintenance in the most common sense of the term—the upkeep of machinery—is a highly developed function in a lamp-manufacturing plant, due primarily to the fact that lamp-making is intricate, subject to constant changes, and involves the most delicate of adjustments for such operations as evacuating the bulbs, introducing the rare gases, sealing the glass. Because of this it calls for the most expert servicing. Specialists are developed for the more important types of machines, and repairs and adjustments are made when and as necessary right on the spot. Work more general in scope is handled in our machine shop, where skilled mechanics apply their specialized knowledge to general overhauling and improvements in equipment design.

Maintenance of both equipment and property is performed on a rigidly prearranged schedule. For example, any piece of equipment that can be depended upon under normal working conditions to operate satisfactorily for six months without the necessity of check-up or adjustment is scheduled for a check-up every four months. The two-month leeway supplies a safety margin which serves to reduce greatly the possibility of unexpected breakdowns. This general policy is adhered to throughout our equipment maintenance program.

In general, our mechanical maintenance problems are of such specialized nature that probably there is little a manufacturer in another industry could apply, but we do feel that the type of maintenance affecting safety, cleanliness, employee comfort, organization morale, and costs cannot be made too important in the whole maintenance picture. Affecting as it does such vital factors, it has to be considered a major function of the superintendent. We feel it has paid us dividends.

In summarizing our thoughts, we feel that strictly observed mechanical maintenance is of such tangible importance that it is obviously essential to the operation of any well-organized industrial plant, but we have the additional feeling that the pursuit of perfection in this endeavor should never permit us to lose sight of that veritable gold mine . . . *good housekeeping.*

# of Employee Morale

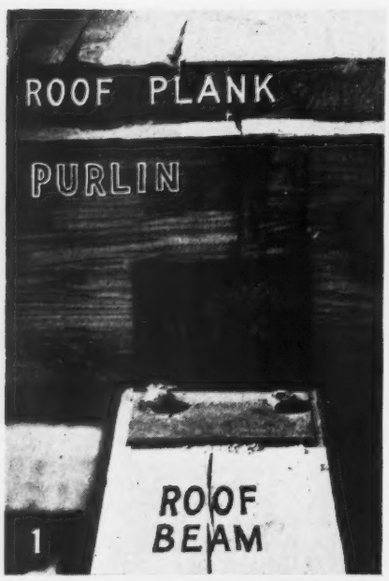
Chester F. Horne is young in years but old in experience. At 37 he is superintendent of lamp manufacturing for Hygrade Sylvania, third largest lamp manufacturer in the United States. Behind him is nearly two decades of experience in the vacuum tube field—experience that embraces time spent in each of Hygrade's two divisions—manufacturing lamps and radio tubes—in engineering production, cost work, maintenance, and administration. When Hygrade Sylvania moved radio tube operations involving 1,500 employees to a new plant, Mr. Horne accomplished the stupendous task of disconnecting, moving, and re-connecting the ponderous and intricate tube-making machinery overnight with an 89 per cent maintenance of production during the operation—which, we affirm, is mighty good going

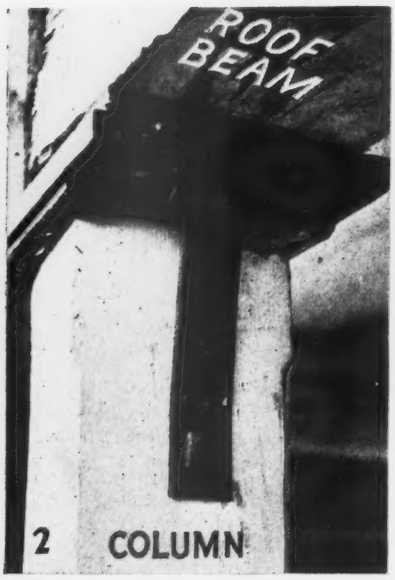
Hold On to Your Roof

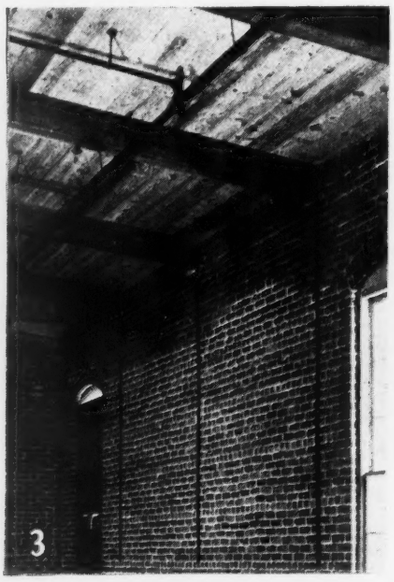
Last month the author described wind damage dangers, particularly to roofs. This month he shows how to anchor roofs against common high-velocity windstorms

HERBERT A. SWEET
Engineer
Associated Factory Mutual Fire Insurance Companies, Boston

IN THE FIVE YEARS preceding 1938, the lifting of unanchored roofs at plants insured by Factory Mutual accounted for 53 per cent of the total wind damage loss although it represented only 10 per cent of the number of windstorm claims. The remaining 47 per cent was on the larger number of losses in which inadequate maintenance played a part. In the 1938 hurricane, 66 per cent of







To provide proper roof anchorage, these details of construction should be incorporated: (1) Purlins to roof beams; (2) roof beam to column top; (3) roof beams to brick wall; (4) and (5) base of top-story column to floor beam; (6) purlins to column top

the wind damage loss was due to the lifting of unanchored roofs, although comprising only 25 per cent of the number of damage claims.

The 1938 hurricane damage, where the lifting of roofs was a factor, was as high as $318,000 in one instance, over $100,000 in eight instances, and averaged $13,000 for 246 cases. Other 1938 hurricane claims averaged $2,300 for 726 losses.

Wind damage to roofs may be prevented by anchoring roof timbers to exterior walls and interior columns, and anchoring columns to floor timbers or to ample-sized footings. This latter item, base anchorage for columns, is particularly important, as in some instances where this has been lacking wind forces have lifted interior roof sections and have pulled in masonry walls, despite the fact that anchorage was otherwise complete.

Tie Members with Steel Bars

Flat steel bars or angles lag-screwed or bolted between roof timbers and walls, roof timbers and columns, and columns and floor timbers provide a tie-in capable of resisting damage in major windstorms, except tornadoes. At walls, these anchor bars should extend down the inner face of the wall to engage a weight of brickwork sufficient to counteract the net uplift of the roof. For inner pilasters or walls thinner than twelve inches, this will involve extending the anchors far down the wall, sometimes to the floor beams or at least below the level of the window sills. Such anchorage can be readily installed in existing construction at moderate cost, and in new construction the added cost is a minor factor.

To determine the necessary length of wall anchorage bars, the net uplift that must be resisted by the anchorage must be taken into account. From wind-tunnel tests, it is estimated that winds may exert an upward force of 30 pounds per square foot over the entire surface of main roofs having a pitch of 20 degrees or less, and as much as 45 pounds per square foot on overhanging eaves and cornices and on monitor roofs. The weight of the roof, which tends to hold the roof in place, may be 12 to 24 pounds per square foot for a plank roof, and 8 to 10 pounds for a joisted roof. The upward force exerted by the wind minus the weight of the roof construction is the "net" uplift that must be resisted by the anchorage. Brickwork weighs approximately 120 pounds per cubic foot and the amount engaged by an anchor bar should be considered as a volume bound by the lowest bolt in the anchor bar and the lines of cleavage extending upward from the bolt along the mortar joists at about 45 degrees with the horizontal.

Frequent inspection and mopping of coverings and flashings helps prevent wind damage

At end walls, roofs of brick buildings are particularly susceptible to wind damage, because a well-anchored wall beam or wall plate, to which the roof planks can be spiked, is not usually available. For new walls or for walls to be reconstructed, a 4 x 8-in. wall beam should be located at the end wall, whether there is a parapet or not. The wall beam should be well anchored horizontally to the wall, using $\frac{5}{8}$-in. bolts about 8 feet apart, lag-screwed to the wall beam and expansion-bolted to the wall. There should always be an anchor near the corner of the wall.

In plank-on-timber construction, at least two $5\frac{1}{2}$-in. spikes for 2-in. planks and 6-in. spikes for 3-in. planks should be used in each plank at every support. End joints of planking should be over supports, and staggered. Planks should be tightly splined, or tongued and grooved, and thoroughly seasoned to reduce shrinkage cracks that would allow pressure to build up under roof covering so as to loosen or tear it.

With joisted construction, the joists should be tied down to the roof timbers at 6-ft. intervals by anchors or twisted bars, and roof boards should be nailed into every joist, using at least two 8-penny nails in each board.

If these roof reinforcements are made, there will be much less to worry about when the next big blow descends on your plant. The roof should withstand the efforts of all common high-velocity winds to tear it off, and still be in place when the storm is over.

Made an Old Plant Like New

Putting up a new plant is one sure way to ease growing pains, but an existing plant, adequately renovated, may provide operating conditions that are exactly as good

C. D. DONAVEN
Vice-President and General Manager
Norge Division, Borg-Warner Corporation
Detroit

TO BUILD A NEW PLANT, or to buy an existing plant and adapt it to one's needs, are the two choices offered a concern pressed for more manufacturing space. Many factors influence the selection of one alternative or the other, and our management, confronted with the problem a few months ago, chose the latter.

We needed this space for the manufacture of refrigerator units that would be shipped to another of our plants for assembly into the refrigerator cabinets. The building selected was a two-story brick structure 680 feet long and 124 feet wide, formerly used by a concern manufacturing ranges.

Smooth Flow Assured

Investigation indicated that sufficient space was available for present needs and for future expansion. Except for the provision of a circulation system for the grinding coolant, no structural revision was necessary, despite what appeared to be an unusually large number of columns for floor and roof support. We found that machine and bench lines, and aisle ways, could be arranged so that the columns offered no obstruction to the smooth flow of work.

The processes that are now accommodated in this building are distinctly precision in character. In making the fabricated parts for the 1/12-hp. compressor, squareness and parallelism are held to 0.00005 inch, and size dimension to plus or minus 0.00015 inch.

Obviously, the only way to secure such precision is to maintain temperature and humidity at a constant level, regardless of outside weather conditions. Then, too, since the plant is located in a busy industrial section of the city, the air supplied to the manufacturing departments must be cleaned in order to protect the machines and measuring devices used, as well as the finish on the machined parts, from dust.

To meet these requirements, finish machining, precision grinding, and inspection and assembly of compressor parts are carried out in sealed and conditioned rooms with sidewalls and ceilings entirely separate from the walls and ceilings of the building.

No windows show in this view of the precision machining room. There aren't any. Plenty of daylight-quality light of even intensity comes from the lighting fixtures, and conditioned air enters through an overhead conical ventilator at the rear. Under roller conveyor at right are located steel plates covering one of the coolant drain trenches

Approximately half the present building width is required for manufacturing. However, a large brazing furnace, a continuous washer, the toolroom, and the shipping department are located in the half of the first floor not included within the insulated portion. Rough machining and heat treatment, although placed in the line of flow of work into the conditioned rooms, are carried on in areas that are not air conditioned.

Walls of the precision machining, inspection, and assembly rooms are constructed of studs insulated on both sides with sheets of insulating material, with fibrous insulation placed between uprights. The ceiling is similarly constructed, except that an air space of 4 inches is provided between the fibrous insulation and the upper sheet of insulation. Steel sheets are placed around the inside of these rooms as a protection for the insulating material, and extend 4 feet upward from the floor.

Since these rooms are completely inclosed, with no natural light coming in through windows, provision had to be made for a type of light that would simulate natural light. With no win-

There's always good lighting on inspection benches because the alternating Mazda and mercury-vapor fixtures can be moved back and forth along the trolley duct to any point desired. The electric gages these inspectors are using, draw power from the same duct

dows, the foot-candles available at work centers can be held constant, uninfluenced by variation in the amount of sunlight outside. Then, too, there is no preferred position near the windows; proper light is provided all over.

To accomplish these results, the lighting layout in these rooms was designed so that 750-watt Mazda lamps alternate with 400-watt, high-intensity mercury-vapor lamps. These lights are placed on 10-ft. centers, 9 feet from the floor. Even distribution is thus secured without glare. Mounting height is controlled by the height of the false insulated ceiling, which is limited by the nature of the building structure to 10 feet. The installation gives 75 foot-candles on the working plane.

A 110-volt cable leads from a transformer through bus duct to lines of trolley duct running the length of the rooms. Lights are hung from this trolley duct. A light panel for each of the rooms makes it possible to control each row of lights separately. The transformers required for the mercury-vapor units are plugged into the trolley duct and the lights connected to these transformers. Mazda lights are plugged directly into the duct.

Repays in Flexibility

Although the original cost of the trolley duct is somewhat higher than that of other types of outlets, its flexibility more than makes up the difference. Lights may be moved longitudinally merely by pushing the plug along the trolley duct, or additional lights may be plugged in at any point; this is a great advantage when equipment layout changes of any sort have to be made.

Power lines from the transformer carry 220 volts for the machines to two lines of bus duct running along the ceiling. The machines are plugged into this duct at whatever point the layout requires. A fused switch is provided on the power duct for each machine.

Conditioned air is just as necessary as a carefully designed lighting system, perhaps more so. Both the material and the employee must be considered; the latter must have comfortable working conditions, and the temperature must be constant in order to work to the close limits mentioned before. In addition, the humidity must not be too high or the highly polished surfaces will rust.

When Cooling Is Necessary

Three 10 x 7½-in. Freon compressors requiring 60 horsepower each can be operated when cooling is necessary. Air in assembly and finishing rooms is changed four times per hour. Air from outside the building, together with air drawn from the rooms, is forced through a filter to remove dust particles. It is then cooled in the washer and reheated to the proper temperature for the 40 per cent relative humidity required by passing it over heating coils. Refrigerating and washing equipment is located on the second floor.

The conditioned air is distributed through ducts to conical ventilators placed in the ceilings of the rooms. Each of these outlets consists of a series of cones placed one within the other; this construction distributes the air evenly without noticeable draft. Return ducts are located at one side of the room near the floor.

Automatic controls are provided to keep the temperature between 72 and 74 degrees F., and relative humidity below 40 per cent. In addition, humidity is frequently checked with a sling psychrometer.

Frequent washings of parts with mineral spirits are required in the precision machining room. This wash is done in specially designed washer booths adjacent to the machines, the working plane of both washer and machine being at the same level.

Soda Water Supply

In the precision machining room there are several large grinding machines that require a constant supply of soda water. It must be kept at the proper temperature to avoid deposits on the work. Also it must be free from particles of abrasive material and metal.

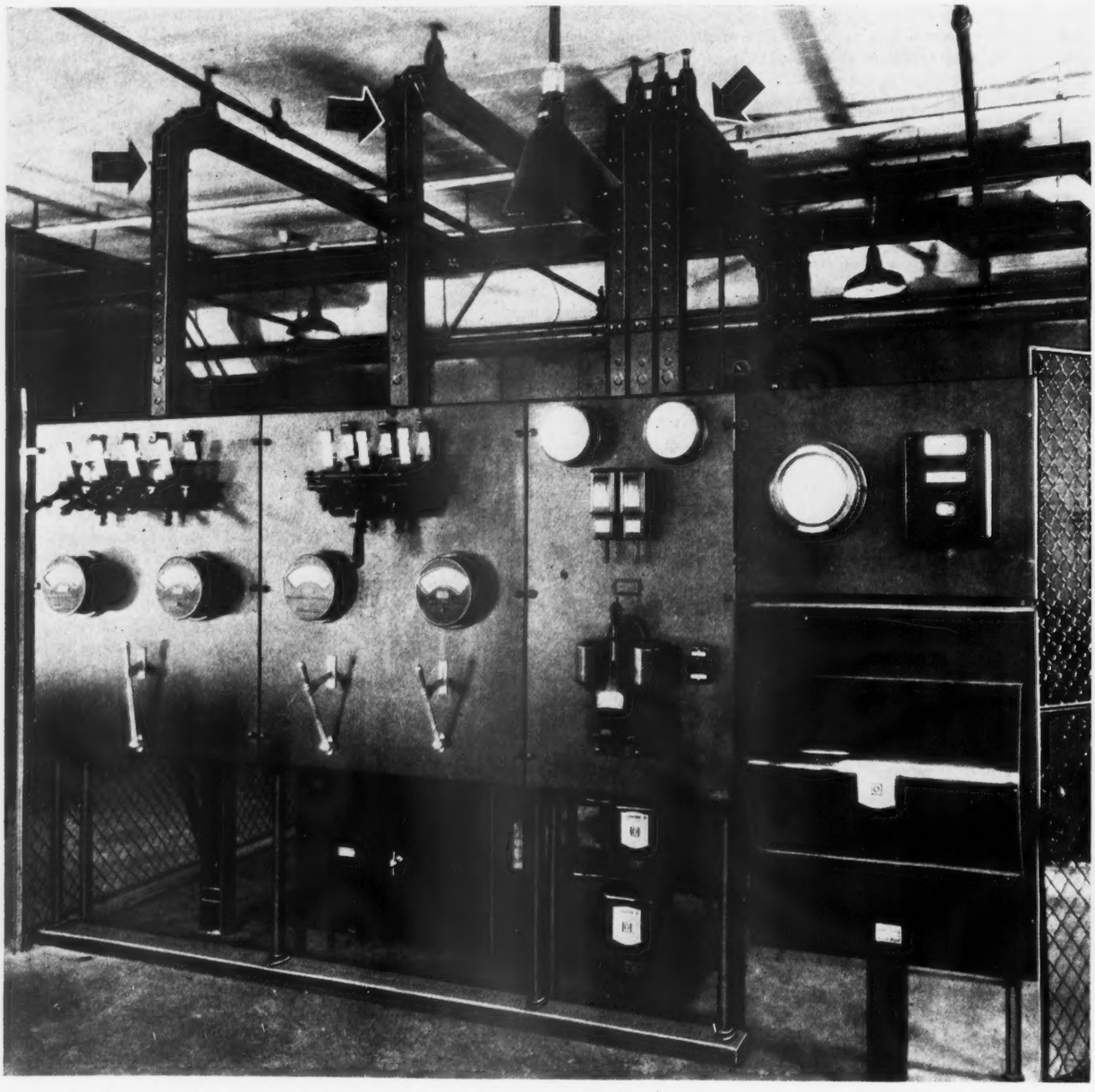
The principal alteration of the building took place at this point. Two parallel concrete drain trenches were cut in the floor and covered with ¼-in. steel plates. Pipes under the floor lead from each grinder to one of these drains.

Two parallel drains 6 feet apart cross these trenches at right angles and lead to two settling tanks, 10 feet square, located outside the air conditioned machining room. These tanks are placed in series; all coolant may be run from the drains into one tank while the other is being cleaned of sludge, which is done every two weeks. Baffles in each tank reduce turbulence and permit the particles carried in suspension to settle. The tanks are located below the floor level, and the necessary pumping equipment is placed between the two tanks. Steam coils located between the tanks heat the coolant to 90 degrees F., after which it is pumped through a pipe system back to the individual machines.

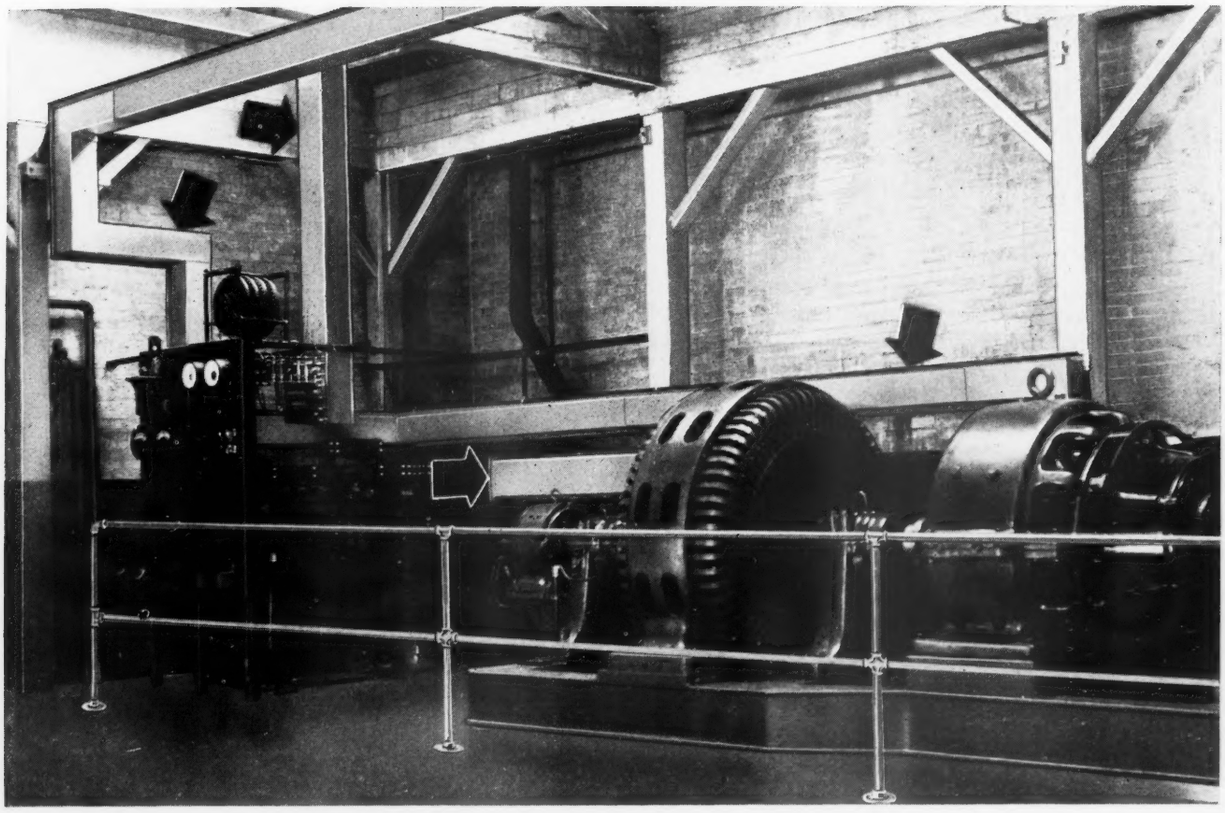
The net result of this installation is a clean and dry floor, a plentiful flow of coolant free from abrasive particles, at a temperature that leaves no deposit on the work.

No attempt has been made in this article to describe detailed processes, nor to describe in any detail the layout of equipment. Instead, attention has been drawn to the possibility of creating satisfactory conditions at minimum investment in a building which, while satisfactory for general manufacturing, was not designed to meet precision manufacturing conditions of today. While a new building is a nice tool to have, the development of satisfactory conditions for maintaining the quality of the product need not wait upon it.

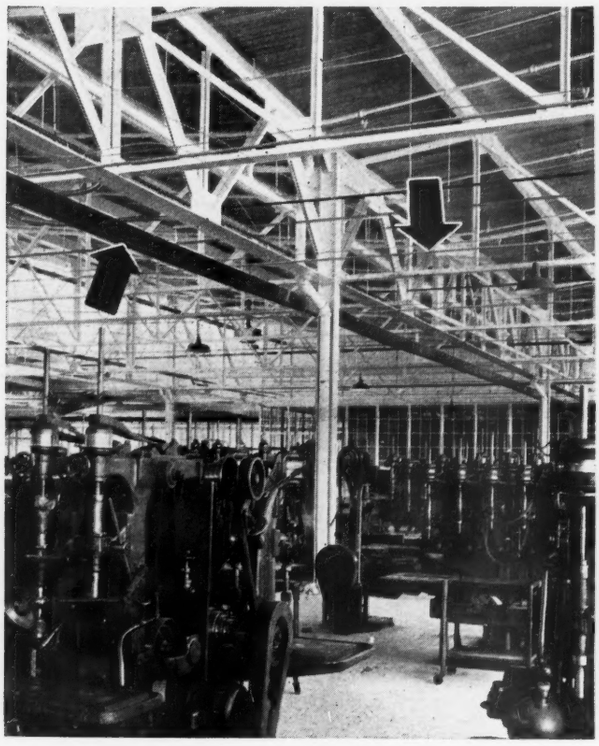
Plug-In Electrical Distribution Insures Flexibility



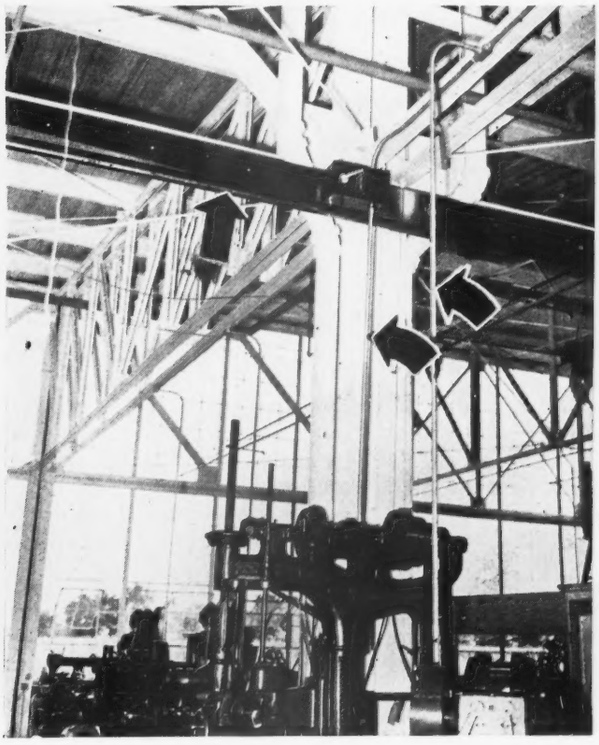
Power circuits in this plant are carried in wiring trough (Square D). Knockouts every 3 inches make tapping off a simple matter



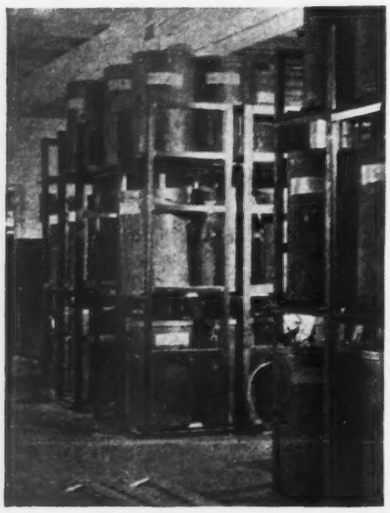
A 1,000-amp. interconnecting feeder distribution system (Trumbull) symplified installation of a motor-generator set in a wire mill



Here bus-duct (Bull Dog) gives flexibility in distribution. Openings on 12-in. centers take plugs through which the motors are fed



When machines are moved the circuit-protective plugs (Bull Dog) are inserted at the new location, without expense or loss of time



Small parts are kept in iron drums piled three high in racks made of angle iron

No Wood, Less Fire

After wooden bins and containers had made a bad fire worse, this plant replaced all such items with equipment built of steel

ROBERT A. TRUMPIS
General Superintendent
Universal Form Clamp Company
Chicago

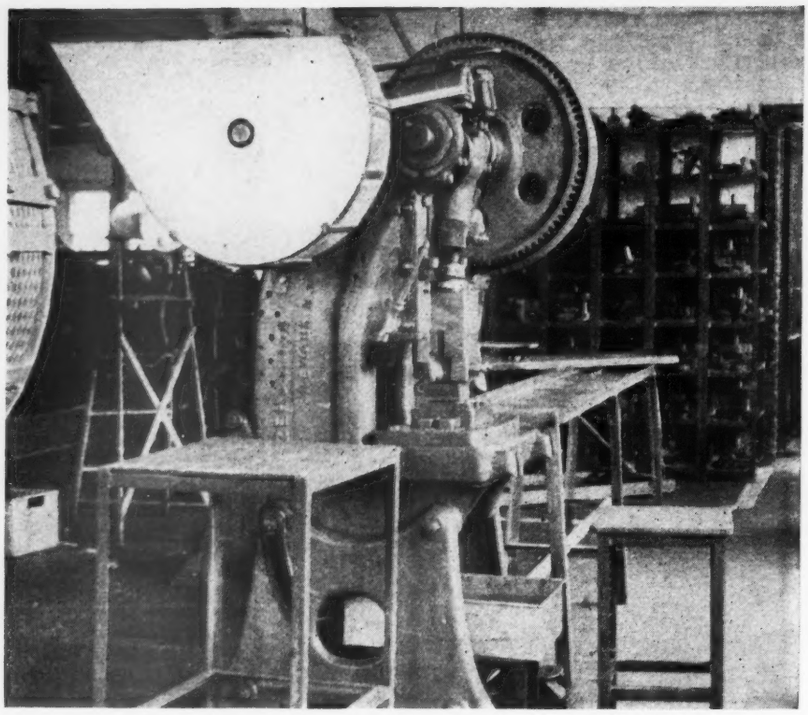
ABOUT TWO YEARS AGO our plant suffered a serious fire during the night, which wiped out 40 per cent of the floor space and completely paralyzed all production. An investigation was immediately started under my supervision to determine the cause of the fire and the reason for its spreading so swiftly. Although the origin of the blaze was not ascertained, it was readily apparent that the fire had been made much more serious by the wooden bins, racks, feed and forming tables, and other miscellaneous items which we used.

Replaced with Steel

When we rebuilt the damaged areas, all the wooden storage and other equipment was discarded, in the interest of reducing fire hazards as much as possible. It was replaced with steel equipment designed to fit our needs. Each department was studied separately to determine what the requirements were.

Stockbins concentrated in different sections of the plant were the largest item of wooden equipment. They were ripped out and replaced with metal bins approximately 4 feet deep, 4 feet high, and 6 feet long.

Equipment for storing materials in process, at stations located in various areas of the plant, next came in for attention. Prior to the fire, small parts had been handled in various-sized wooden boxes, barrels, kegs, and tote pans. They were untidy, always an open invitation for the men to throw refuse into them, and were not only unsafe from the standpoint of fire hazard, but uneconomical in use of floor space.



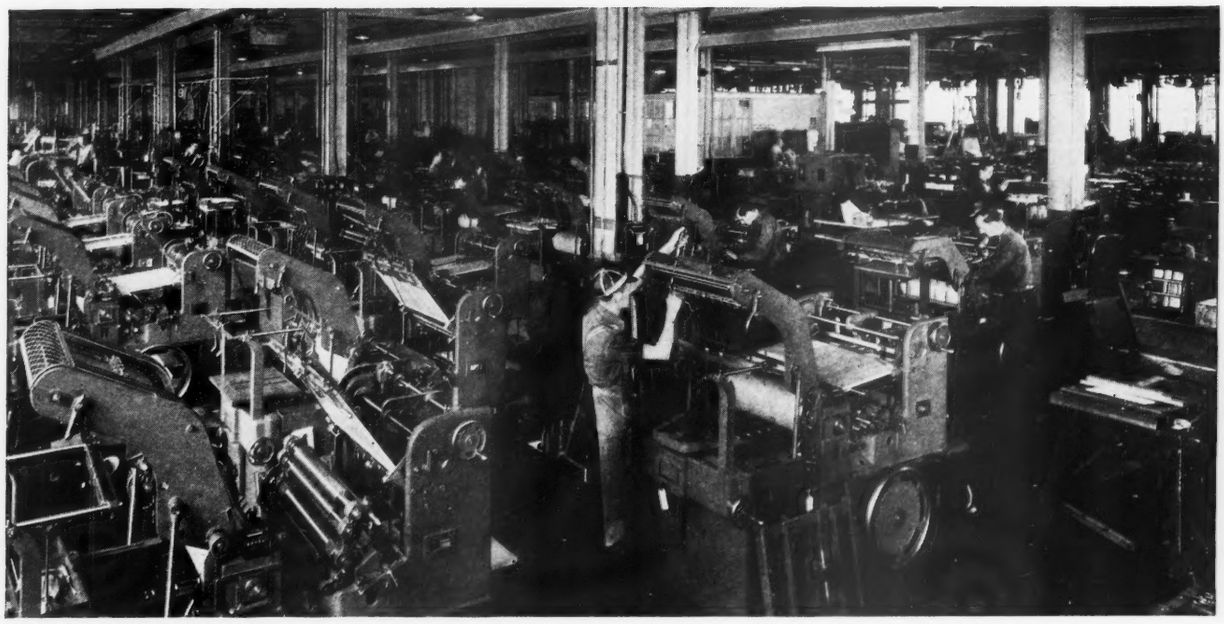
All equipment is now made of steel. This includes tables, stools, chairs, stock racks

These conditions were remedied by purchasing a large number of steel drums and designing steel racks in which these drums can be piled three high. The drums and racks eliminated the previous fire hazard from this type of storage and reduced the floor space formerly required.

A large amount of wooden equipment in the form of tables, stock racks, stools or chairs, and so on, is frequently concentrated in punchpress departments and machine shops. Our plant was no exception, but now every one of the old wooden items has been replaced by steel designs that are neater, stronger, and safer than the old ones ever were.

When the major hazards had been eliminated according to a definite schedule, we started in to replace all miscellaneous wooden equipment such as workbenches, trucks, tool cribs, tote pans—everything in fact that could be designed and constructed of steel. Our aim is the eventual complete elimination of all combustible equipment, and we are well on the way towards realizing it.

It would probably be too much to say that a fire could not start in our plant, but at least there is a minimum of wood to intensify it, and keep it going.



This company's incentive plan is based on the axiom that good maintenance service is necessary for good production performance

Bonus for Maintenance Supervisors

So closely tied in with production efficiency is this plan that only one-third of a maintenance supervisor's bonus depends on the competence with which maintenance work is done; other two-thirds, on the effectiveness of the manufacturing division to which he is attached

H. I. LEWIS

Vice-President, American Type Founders, Incorporated
Elizabeth, N. J.

IT IS SOMEWHAT DIFFICULT to give a precise picture of our maintenance incentives as distinct from production and other incentives, since the basic scheme of efficiency incentives adopted by the company some time ago is a general plan which takes maintenance factors into account, but does not completely segregate them.

Perhaps a little background will help to clarify our problem and our methods. American Type Founders, Incorporated, carries on two different and quite distinct manufacturing processes in its Elizabeth plant—the manufacture of printing presses and the manufacture of movable printers' type. Until recently the same staff of service and maintenance employees served the Machinery Division and the Type Foundry.

Direct labor in both manufacturing divisions has for a number of years been on an incentive or premium basis. It was impractical, however, to apply a similar system of incentive to service and maintenance employees because their work did not lend itself to time-study analysis.

Three years ago we determined to initiate a Supervisors' Bonus Plan which would not only give supervisors a direct interest in plant efficiency, but also permit emphasis on the importance of efficiency in service and maintenance as well as in direct production.

The plan originally established was broken down into three divisions: Machinery Manufacturing, Foundry, and Manufacturing Service. Bonuses were paid to supervisors in each division (in addition to base salaries) on the basis of the fulfillment of monthly budgets established in advance by agreement between the supervisors and the management. These budgets were worked out through the application of a series of standard costs. For direct-labor operations, these costs were established through time studies of actual work go-

H. I. Lewis was graduated from M. I. T. in mechanical engineering, and has had an unusually broad industrial experience covering design, manufacturing, sales, and management in various companies. He is active in many technical organizations. For the American Type Founders he has recently consolidated and modernized plants, and completely reorganized manufacturing methods and operations. Mr. Lewis is a Lieutenant-Colonel in the Ordnance Reserve, now assigned as Chief of Artillery in the New York District. His main hobby and chief delight is yachting

ing through the plant. For indirect labor, variable expenses, and certain other factors, standard costs were established on the basis of experience in terms of a cost-per-hour ratio to direct-labor costs.

Under the original plan, part of the bonus earned by the Manufacturing Service Division was contributed on the basis of a fixed percentage by the Machinery Manufacturing Division and the Foundry Division out of the aggregate bonuses earned by those divisions, because good maintenance service is necessary for good production performance.

It should be understood that no bonus is earned by an individual supervisor; bonuses are earned as a lump sum by the performance of the whole division and are subsequently prorated among the supervisors of that division according to a fixed scale. This makes for better teamwork.

Recently the service and maintenance employees were divided between the Machinery Division and the Foundry Division, and the bonus plan was revamped so that service and maintenance factors were taken directly into consideration in calculating bonus earnings in each division.

Today the supervisor's bonus plan for the Machinery Manufacturing Division, for example, is governed by five major factors:

	Per Cent
1. Direct labor	25
2. Indirect labor	25
3. Variable expenses	25
4. Factory errors and defective materials	14
5. Safety	6
	95

Certain maintenance factors are included under the headings "indirect labor" and "variable expenses," such as cleaning machinery, small tool cost and maintenance, and expense of moving machinery.

The Other 5 Per Cent

Three subsidiary factors also affect the plan, but apply only to the bonus earnings of the supervisors in charge of service and maintenance. These factors are:

	Per Cent
1. Reduction in monthly budget authorization charges	2
2. Meeting budget on certain overhead indirect labor	2
3. Completing special expenditure authorizations on schedule	1
	5

These factors bear exclusively on maintenance efficiency; for that reason some explanation of them is in order.

Experience indicated to us that we were spending a substantial amount of money each month directly on maintenance. These expenditures were analyzed and broken down under thirteen heads. For each of these subdivisions we established a monthly budget, based on the average expenditure under that heading over a period of months. These budget figures are referred to as "Monthly Budget Authorizations" and serve as a yardstick for measuring the efficiency of the maintenance crew under the bonus plan.

The maintenance supervisor is likewise directly responsible for the work of the porters, the boiler room employees, and certain others. His bonus is partly dependent upon not exceeding his budget for this indirect labor.

Sticking to Schedules

Finally, it is our practice, when special work of one kind or another is to be done, to issue a "Special Expenditure Authorization." In order more accurately to budget our labor on these special jobs, they are carefully scheduled as to time of production. The maintenance supervisor receives part of his bonus for getting this work done on schedule.

These three factors, however, account for only about one-third of the possible efficiency bonus which the maintenance supervisor may earn. The rest is dependent upon the efficiency of the Machinery Division as a whole. In other words, it is impossible under our incentive plan (and in our experience undesirable) to segregate maintenance efficiency incentive factors entirely from production incentive factors.

Our purpose in the establishment of our supervisors' bonus plan has been twofold: To make our supervisors expense-minded, and to make the supervisory group in each division *as a whole* responsible for the results of the whole division.

Every supervisor knows just what factors are taken into consideration in calculating the monthly bonus, and at the end of each month every supervisor knows the exact percentage of efficiency achieved by the division under each heading. It is easy, therefore, for the supervisors themselves to place the responsibility for an increase or decrease in bonus payments. This gives every man an interest not only in his own work, but also in the work of his fellow-supervisors. By this means, team play and cooperation are encouraged.

Since the supervisors and the company share in any savings achieved through greater efficiency in the plant, it is clear that, whenever a bonus is paid to supervisors, the company has likewise benefited. Certainly neither company nor supervisors themselves would consider abandoning the plan.

MAINTENANCE SERVICE SHORTS

Readers are invited to contribute brief illustrated articles reporting out-of-the-ordinary maintenance accomplishments. Accepted articles will be paid for

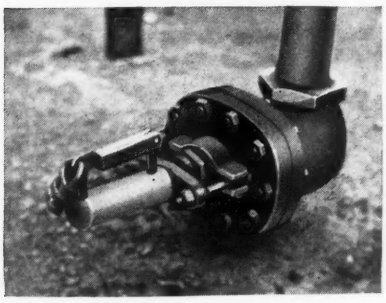
BUILDINGS AND SERVICES

Tamper-Proof Lock for Valve Prevents Theft

ELTON STERRETT, *Longview, Tex.*

Where large quantities of flammable solvents and volatile fuels are stored in exposed places, safety and economy demand provision for locking the valves to prevent pilferage and meddling.

One concern devised the locking device shown in the illustration after it was found that mere removal of the valve handwheel did not deter thieves. The valve stem was put in a lathe and a groove ½ inch wide and ⅛ inch deep was turned in it just outside the normal position of the gland. A sleeve was then formed to fit over the stem, completely covering it and preventing the use of a



pipe wrench to turn the stem in the absence of the handwheel. This sleeve was drilled and tapped to take a ⅝-in. bolt near the open end. The bolt was cut down to fit a yoke in the locking member.

To secure the valve, the sleeve is slipped over the stem and the bolt turned down with the yoked bar until the end enters the groove in the stem. The other end of the locking bar is then turned down until a hole in its outer end registers with an eyelet welded to the closed end of the sleeve, through which a heavy padlock is placed.

Since the sleeve is free to turn on the stem it cannot be used as a wrench hold, nor can the bolt be released when the bar is padlocked in position.

Since the installation of this lock, all thefts have ceased.

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Where steam main insulation is likely to be struck, rubbed, or injured in some other way, it should be wrapped with tight sheet metal sleeving.

•

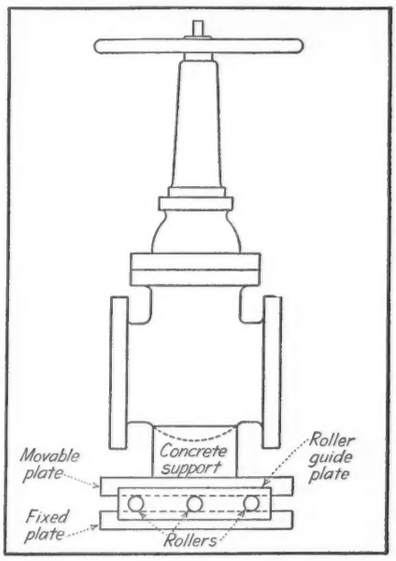
Roller Mounting Prevents Valve Flange Breakage

M. T. PATE, *Longview, Tex.*

Frequent fractures of the gate valve companion flanges on the six-inch, high-pressure main line were traced to the combined effect of expansion and contraction stresses, and the inertia of the gate mass under the pounding of the triplex pump handling the fluid. Each pump impulse tended to shake the gate body on its flanges, the effect eventually resulting in fatigue of the metal and failure in one or the other of the flanges.

The trouble located, the original wooden blocking supporting the gate was removed, and a slab of 1-in. boiler plate grouted to the bottom of the concrete gate pit. On top of this plate were set three rollers cut from 2-⅛-in. shafting, the rollers supporting a second piece of boiler plate. A form was built between this upper plate and the bowl of the valve, and the form filled with concrete. Positioning of the concrete block on the slab was assured by welding a number of short bits of steel to the top of the plate, within the limits of the form, before placing the concrete.

Since the motion imparted the valve



and its supporting plate by fluid impulses tended to shift position of the supporting rollers, their initial spacing was maintained by two rectangular guide plates of ¼-in. steel, bored to slip over ends of the three rollers, permitting the rollers to turn in unison, yet prevent this shifting or segregating.

Although this support has been in service three times as long as the former best period between breaks, as yet no failure has been detected in either gate or companion flanges.

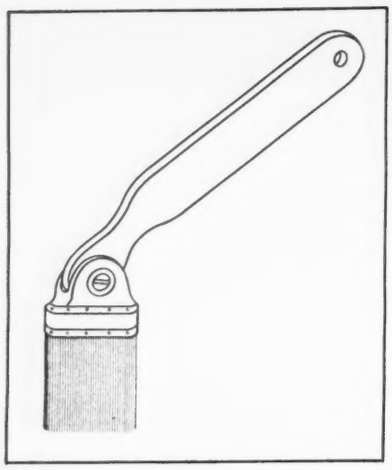
•

Handy Paint Brush Has Adjustable Handle

C. H. WILLEY, *Penacook, N. H.*

Necessity of painting behind coping and in certain other places where it was not possible to use an ordinary paint brush presented a problem that was solved by making the brush shown in the sketch. There are many places where such a brush can be used to good advantage.

As will be seen, it can easily be made



from a standard brush by cutting off the regular handle and sawing a wide slot into which is inserted a handle of the shape shown. A screw with nut and washer hold this handle at any angle desired.

•

For fire protection around costly machine tools, have a supply of soapstone or talc on hand rather than sand. Sand, if used, can damage the machinery.

•

Floor Wax Keeps Machines Clean and Bright

DAVID SCOTT, *Nelson, B. C., Canada*

Floor wax is a means of preserving and keeping machinery clean. It is particularly advantageous in dairies because it stands up under typical dairy conditions. In spite of steam and changing temperatures, compressors and churns can be kept brightly shining at all times if coated with floor wax.

Before wax is applied, the machinery must be thoroughly cleaned with a grease-cutting soap solution. After it has been rinsed and allowed to dry, the wax can be rubbed on with a cloth, and then polished with another cloth or chamois.

Little attention need be given a waxed machine after the initial waxing. When a machine becomes hot the wax will, of course, soften, but on cooling it hardens again and looks as shining as before. A daily run over with a clean rag will keep machines free from dust and oil or water marks. Dirt does not readily adhere to the waxed surface and can be wiped off easily. About once a month it is necessary to replenish the wax. In this process the first coating of wax need not be removed; the second coat can simply be applied over it. Perhaps once a year, the wax will become soiled and need to be completely washed off.

Floor wax used in this way will save time and painting costs. As a preserver and brightener it will prove most valuable to dairies and factories where machinery must be kept just right.

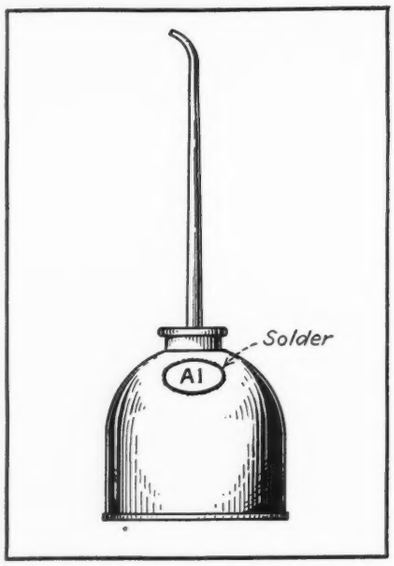
•

A Bit of Solder Helps in Marking Metal Containers

S. H. COLEMAN, *Roanoke, Va.*

Identifying thin metal containers by cutting the desired information with steel stencils is often hard to do without distorting the surrounding metal or otherwise marring the object.

This difficulty can be overcome in many instances by building up the area to be marked with soft solder, and stenciling the identification in this material. This scheme is particularly valuable as a means of marking small oil cans, measuring cups, pails, and similar metal receptacles which are so frequently carried off and misplaced. It also identifies containers so that they are not filled with materials for which they are not intended.



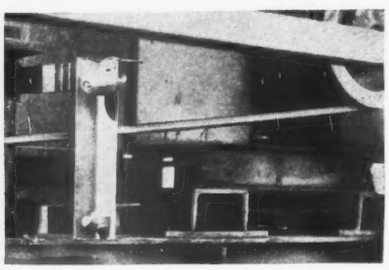
MECHANICAL POWER TRANSMISSION

Padlocked Guard Keeps V-Belts in Place

CHARLES C. LYNDE, *Kilgore, Tex.*

Fitted with remote control so that it could be started and stopped from the main power plant half a mile away, a motor-driven pumping plant frequently failed to deliver. The trouble was nearly always found to be in the drive between motor and centrifugal pump—the V-belts having been stripped off and stolen in most instances.

To permit locking the belts in place, a bracket was welded to the pump frame at its outer end, supporting a bar which normally swung down across the set of belts. This bar was pivoted on a 1-in. bolt at its lower end, the nut being spot welded in place to prevent its unauthorized removal. A padlock was used to fasten top of the bar and projecting bracket together.



In changing belts it was only necessary to open the padlock, lift the bar, and proceed in the normal manner, locking the bar in place at conclusion of the work to insure that belts would still be in place when the remote control was operated next time.

•

Free-Wheeling Clutch Takes Up Gear Backlash

D. L. FITZHUGH, *Old Hickory, Tenn.*

There are many new applications for free-wheeling clutches appearing today. We use one to take care of the backlash in a train of gears.

When the machine is stopped the clutch prevents one of the gears from turning backwards as much as the backlash would allow. The housing of the clutch is bolted to the gear, while the inner member is keyed to a shaft that is part of the stationary frame.

This arrangement reduces the amount of defective production and thereby improves the quality of our product.

DATA SHEET No. 11 MAINTENANCE SERVICES

Standards of Illumination for Industrial Interiors

Recommended by the

ILLUMINATING ENGINEERING SOCIETY

These foot-candle values represent order of magnitude rather than exact levels of illumination

	Foot-candles
Aisles, Stairways, Passageways	**5**
Assembly:	
Rough	10
Medium	20
Fine	50–100
Extra Fine	100+
Automobile Manufacturing:	
Assembly Line	50–100
Frame Assembly	15
Body Manufacturing:	
Parts	20
Assembly	20
Finishing and Inspecting	100+
Bakeries	**20**
Bookbinding:	
Folding, Assembling, Pasting, etc.	10
Cutting, Punching, Stitching	20
Embossing	20
Breweries:	
Brew House	5
Boiling, Keg Washing, Filling	10
Bottling	15
Candy Making:	
Box Department	20
Chocolate Department:	
Husking, Winnowing, Fat Extraction, Crushing and Refining, Feeding	10
Bean Cleaning and Sorting, Dipping, Packing, Wrapping	20
Milling	30–50
Cream Making:	
Mixing, Cooking, Molding	20
Gum Drops and Jellied Forms	20
Hand Decorating	30–50
Hard Candy:	
Mixing, Cooking, Molding	20
Die Cutting and Sorting	30–50
Kiss Making and Wrapping	30–50
Canning and Preserving	**20**
Chemical Works:	
Hand Furnaces, Boiling Tanks, Stationary Driers, Stationary and Gravity Crystallizers	5
Mechanical Furnaces, Generators and Stills, Mechanical Driers, Evaporators, Filtration, Mechanical Crystallizers, Bleaching	10
Tanks for Cooking, Extractors, Percolators, Nitrators, Electrolytic Cells	15
Clay Products and Cements:	
Grinding, Filter Presses, Kiln Rooms	5
Molding, Pressing, Cleaning and Trimming	10
Enameling	15
Color and Glazing	20
Cleaning and Pressing Industry:	
Checking and Sorting	20
Dry and Wet Cleaning and Steaming	10
Inspection and Spotting	100+
Pressing:	
Machine	20
Hand	30–50
Receiving and Shipping	10
Repair and Alteration	30–50
Cloth Products:	
Cutting, Inspecting, Sewing:	
Light Goods	20
Dark Goods	100+
Pressing, Cloth Treating (Oil Cloth, etc.)	
Light Goods	10
Dark Goods	20
Coal Tipples and Cleaning Plants:	
Breaking, Screening, Cleaning	10
Picking	100+
Construction—Indoor:	
General	10
Dairy Products	**20**
Elevators—Freight and Passenger	**10**
Engraving	**100+**
Forge Shops and Welding	**10**
Foundries:	
Charging Floor, Tumbling, Cleaning, Pouring and Shaking Out	5
Rough Molding and Core Making	10
Fine Molding and Core Making	20
Garages—Automobile:	
Storage—Live	10
Storage—Dead	2
Repair Department and Washing	30–50
Glass Works:	
Mix and Furnace Rooms, Pressing and Lehr, Glass Blowing Machines	10
Grinding, Cutting Glass to Size, Silvering	20
Fine Grinding, Polishing, Beveling, Etching and Decorating	30–50*
Inspection	50–100*
Glove Manufacturing:	
Light Goods:	
Pressing, Knitting, Sorting	10
Cutting, Stitching, Trimming, Inspection	20
Dark Goods:	
Cutting, Pressing, Knitting, Sorting	20
Stitching, Trimming, Inspection	100+
Hangars—Airplane:	
Storage—Live	10
Repair Department	30–50
Hat Manufacturing:	
Dyeing, Stiffening, Braiding, Cleaning, Refining:	
Light	10
Dark	20
Forming, Sizing, Pouncing, Flanging, Finishing, Ironing:	
Light	15
Dark	30
Sewing:	
Light	20
Dark	100+
Ice Making—Engine and Compressor Room	**10**
Inspection:	
Rough	10
Medium	20
Fine	50–100
Extra Fine	100+
Jewelry and Watch Manufacturing	**100+**
Laundries	**20**
Leather Manufacturing:†	
Leather Working:†	
Locker Rooms	**5**
Machine Shops:	
Rough Bench and Machine Work	10
Medium Bench and Machine Work, Ordinary Automatic Machines, Rough Grinding, Medium Buffing and Polishing	20
Fine Bench and Machine Work, Fine Automatic Machines, Medium Grinding, Fine Buffing and Polishing	50–100
Extra Fine Bench and Machine Work, Grinding:	
Fine Work	100+
Meat Packing:	
Slaughtering	10
Cleaning, Cutting, Cooking, Grinding, Canning, Packing	20
Milling—Grain Foods:	
Cleaning, Grinding, Rolling	10
Baking or Roasting	20
Flour Grading	30
Offices:	
Bookkeeping, Typing, Accounting	30
Business Machines—Power Driven (Transcribing and Tabulating):	
Calculators, Key Punch, Bookkeeping	50–100
Conference Room	
General Meetings	10
Office Activities—See Desk Work	
Corridors and Stairways	5
Desk Work:	
Intermittent Reading and Writing	20
Prolonged Close Work, Computing, Studying, Designing, etc.	30–50
Reading Blueprints and Plans	30
Drafting	
Prolonged Close Work—Art Drafting and Designing in Detail	30–50
Rough Drawing and Sketching	30
Filing and Index References	20
Lobby	10
Mail Sorting	20
Reception Rooms	10

† I.E.S. research study of lighting in this industry is now in progress.

Standards of Illumination for Industrial Interiors

Recommended by the

ILLUMINATING ENGINEERING SOCIETY

	Foot-candles
Stenographic Work	
Prolonged Reading Shorthand Notes	30–50
Vault	10
Packing and Boxing	**10**
Paint Mixing	**10**
Paint Shops:	
Dipping, Simple Spraying, Firing	10
Rubbing: Ordinary Hand Painting and Finishing; Art, Stencil and Special Spraying	20
Fine Hand Painting and Finishing	50–100
Extra Fine Hand Painting and Finishing (Automobile Bodies, Piano Cases, etc.)	100+
Paper Box Manufacturing:	
Light	10
Dark	20
Storage	5
Paper Manufacturing:	
Beaters, Grinding, Calendering	10
Finishing, Cutting, Trimming, Paper Making Machines	20
Plating	**10**
Polishing and Burnishing	**15**
Power Plants, Engine Room, Boilers:	
Boilers, Coal and Ash Handling, Storage Battery Rooms	5
Auxiliary Equipment, Oil Switches and Transformers	10
Engines, Generators, Compressors	15
Switchboards	30–50
Printing Industries:	
Type Foundries:	
Matrix Making, Dressing Type	100+
Font Assembly—Sorting	50–100
Hand Casting	30–50
Machine Casting	20
Printing Plants:	
Presses	30–50
Imposing Stones	100+*
Proof Reading	100+
Photography:	
Dry Plate and Film	2,000
Wet Plate	3,000
Printing on Metal	2,000
Electrotyping:	
Molding, Finishing, Leveling Molds, Routing, Trimming	50–100
Blocking, Tinning	30–50
Electroplating, Washing, Backing	20
Photo Engraving:	
Etching, Staging	20
Blocking	30–50
Routing, Finishing, Proofing	50–100
Tint Laying	100+
Receiving and Shipping	**10**
Rubber Manufacturing and Products:†	
Sheet Metal Works:	
Miscellaneous Machines, Ordinary Bench Work	15
Punches, Presses, Shears, Stamps, Welders, Spinning, Medium Bench Work	20*
Tin Plate Inspection	50–100*
Shoe Manufacturing (Leather):	
Cutting and Stitching:	
Cutting Tables	10
Marking, Buttonholing, Skiving, Sorting, Vamping, and Counting:	
Light Materials	20
Dark Materials	30–50
Stitching:	
Light Materials	30–50
Dark Materials	50–100
Making and Finishing:	
Light Materials	20
Dark Materials	30–50
Storage, Packing, Shipping	10
Shoe Manufacturing (Rubber):	
Washing, Coating, Mill Run Compounding	10
Varnishing, Vulcanizing, Calendering, Upper and Sole Cutting	30–50
Sole Rolling, Lining, Making and Finishing Processes	30–50
Soap Manufacturing:	
Kettle Houses, Cutting, Soap Chip and Powder	10
Stamping, Wrapping and Packing, Filling and Packing Soap Powder	20
Steel and Iron Manufacturing:	
Billet, Blooming, Sheet Bar, Skelp and Slabbing Mills	5
Boiler Room, Power House, Foundry and Furnace Rooms	5
Hot Sheet and Hot Strip Mills	10
Cold Strip, Pipe, Rail, Rod, Tube, Universal Plate and Wire Drawing	10**
Merchant and Sheared Plate Mills	15**
Tin Plate Mills:	
Hot Strip Rolling and Tinning	10
Cold Strip Rolling	15
Inspection:	
Black Plate	30–50
Bloom and Billet Chipping	30–50
Tin Plate and Other Bright Surfaces	50–100*
Machine Shops and Maintenance Department:	
Repair Shops:	
Rough Bench, Machine Work	10
Medium Bench and Machine Work	20
Fine Work—Buffing, Polishing, etc.	50–100
Extra Fine Work	100+
Blacksmith Shop	10
Laboratories (Chem. and Physical)	15
Carpenter and Pattern Shop	20
Storage	2
Stone Crushing and Screening:	
Belt Conveyor Tubes, Main Line Shafting Spaces, Chute Rooms, Inside of Bins	5
Primary Breaker Room, Auxiliary Breakers under Bins	5
Screens	10
Storage Battery Manufacturing:	
Molding of Grids	10
Store and Stock Rooms:	
Rough Bulky Material	5
Medium or Fine Material Requiring Care	10
Structural Steel Fabrication	**10**
Sugar Grading	**30**
Testing:	
Rough	10
Fine	20
Extra Fine Instruments, Scales, etc.	100+
Textile Mills (Cotton):	
Opening, Mixing, Picking, Carding, Drawing	10
Slubbing, Roving, Spinning	20
Spooling, Warping on Comb	20
Beaming, and Slashing on Comb:	
Gray Goods	20
Denims	50–100
Inspection:	
Gray Goods (Hand Turning)	30–50
Denims (Rapidly Moving)	100+
Automatic Tying-In, Weaving	50–100
Drawing-In by Hand	100+
Silk and Rayon Manufacturing:	
Soaking, Fugitive Tinting, and Conditioning or Setting of Twist	10
Winding, Twisting, Rewinding, and Coning, Quilling, Slashing	30
Warping (Silk or Cotton System) on Creel, on Running Ends, on Reel, on Beam, on Warp at Beaming	30–50
Drawing-In:	
On Heddles	100+
On Reed	100+
Weaving:	
On Heddles and Reeds	5
On Warp Back of Harness	10
On Woven Cloth	30
Woolen:	
Carding, Picking, Combing	10
Twisting, Dyeing	10
Drawing-In, Warping:	
Light Goods	15
Dark Goods	30
Weaving:	
Light Goods	15
Dark Goods	30
Knitting Machines	20
Tobacco Products:	
Drying, Stripping, General	10
Grading and Sorting	100+
Toilets and Wash Rooms	**5**
Upholstering — Automobile, Coach Furniture	**20**
Warehouse	**5**
Woodworking:	
Rough Sawing and Bench Work	10
Sizing, Planing, Rough Sanding, Medium Machine and Bench Work, Gluing, Veneering, Cooperage	20
Fine Bench and Machine Work, Fine Sanding and Finishing	30–50

** In these areas many of the machines require one or more supplementary lighting units mounted on them in order to direct light toward working points.

* The seeing tasks here require the discrimination of fine detail by utilizing (a) the reflected image of a luminous area or (b) the transmitted light from a luminous area. The essential requirements are (1) that the luminous area shall be large enough to cover the surface inspected and (2) that the brightness be within the limits necessary to obtain comfortable contrast conditions.

EFFECTIVE TEAMWORK

That's why the Exide System handles all material-handling situations so successfully

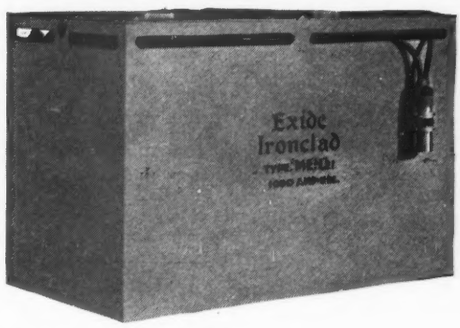
What is the Exide System? Power-packed Exide-Ironclad Batteries PLUS equipment that insures your receiving the power, performance and long life they're built to deliver.

For instance, of the many types and sizes of Exide-Ironclads available, the Exide System determines scientifically, accurately, quickly, the type and size best fitted for *your specific trucking requirements.* Then, by equipment that is almost entirely automatic, the Exide System insures proper care for your batteries . . . and so utmost performance.

An Exide Discharge Indicator, mounted on your truck, flashes a warning when the battery nears the discharge point, thus eliminating delays and tow-ins. The Exide Charge Control Unit on your charging panel *automatically* controls the rate of charge and, when charge is complete, cuts the circuit and signals "All ready!"

As a result of this time-saving teamwork, more materials are handled, faster, more efficiently, at lower cost. Why not write for details?

Exide
IRONCLAD
BATTERIES
With Exide MIPOR Separators
"MIPOR," Reg. U. S. Pat. Off.



THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia
The World's Largest Manufacturers of Storage Batteries for Every Purpose
Exide Batteries of Canada, Limited, Toronto

You Want to Know

more about the items mentioned on this page.
Letters to the addresses given will bring information

• CEMENT, synthetic resin type, is impervious and inert to all but the highly oxidizing acids, and inert to oils, water, and mild alkalis at temperatures up to 330 degrees Fahrenheit. The Atlas Mineral Products Co., Mertztown, Pa.

• METERS for measuring currents and voltages of short duration have a stop which is moved by micrometer screw down or up against the pointer, until the pointer barely moves in response to current or voltage impulse. General Electric Co., Schenectady, N. Y.

• PLANER SLOT CLEANER is handy little tool for removing metal chips from table slots of milling machines, planers, and other machine tools. Dayton Rogers Mfg. Co., 2830 South 13th Ave., Minneapolis.

ROUTINE CALCULATION ten times faster than manual calculation is the claim made for this light-weight, noiseless calculator which multiplies, divides, pro-rates, figures fractions and percentages. Its workings are in an aluminum case with transparent plastic windows. Paisley Calculator Co., Farmers Bank Bldg., Pittsburgh

• WORKERS PAST 40 are handicapped in job seeking asserts a pamphlet, "Jobs After Forty," which blames mistaken employment policies. Some facts to dispute the belief that older workers are less productive and prone to accidents, are presented by the author, who includes some recommendations for solving the problem. 10¢. Public Affairs Committee, 30 Rockefeller Plaza, New York.

• GASKET MARKER simplifies the task of marking and outlining gasket sizes on sheet packing. After the gasket has been outlined with the marker and a pencil, it can be quickly cut out with knife or shears. Crane Packing Co., 1800 Cuyler Ave., Chicago.

• AMPLE OPPORTUNITY for the private citizen to invest his savings in private enterprise still exists, is the contention set forth in a booklet "Saving and Investment in the American Enterprise System," which contains an analysis of testimony on this subject presented in Washington before the Temporary National Economic Committee. Machinery and Allied Products Institute, 221 North La Salle St., Chicago.

• PAPERS presented at last American Management Association Production Conference are available in pamphlet form: "A Symposium on Unit Costs," $1; "Public and Industrial Relations in Production," 75¢; "Quality and Inventory Control," 75¢. American Management Association, 330 West 42d St., New York.

• GLASS BUILDING BLOCK contains interior screen of glass fiber that cuts down heat transfer and keeps cooling load in air conditioned rooms low. The block itself gives soft, diffused light that reduces sun glare. Pittsburgh Plate Glass Co., Pittsburgh, Pa.

• TELLTALE automatically flashes light signal when it is time to change or clean filter on air conditioning equipment. Excess static pressure built up between filters and blower causes signal to light. Simplex Controls Division of the Herbusch Corp., 706 Chestnut St., St. Louis.

• CLEANING GUN, operating on compressed air, shoots kerosene or other cleaner when its nozzle is pressed against the part to be cleaned. Oil-resisting hose attached to the gun is run to a bucket of the cleansing agent. Lonn Mfg. Co., 625 West Jackson Blvd., Chicago.

• HUMANITARIAN and economic considerations together make eye protection a live subject to which industry is giving much attention. Symposium on the subject includes one mighty helpful paper on how to set up and put across an eye protection program. 15¢. National Society for the Prevention of Blindness, Inc., 50 West 50th St., New York.

• "FENCE-BOND" is name of an aluminum paint that can be applied to rusted chain link fence without removing the rust. It dries from the outside, it's said, retaining an elasticity that prevents chipping when the fence joints move. The Skybryte Co., Cleveland.

• TRACING PAPER that doesn't turn yellow, become brittle, or lose transparency with age, is said to have high transparency and superior blueprinting quality. Keuffel & Esser Co., Hoboken, N. J.

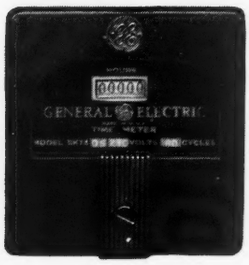
A CEILING OF REFLECTORS is what you have in an installation of these ceiling reflector units that direct light from indirect luminaires downward upon working surfaces. "Parak-O-Lume" units, as they are called, are described as "a parabolic reflector transformed to a flat surface." They're made from steel sheets stamped in prismatic design and painted with aluminum paint. Berger Manufacturing Division, Republic Steel Corp., Canton, Ohio

• MOLDS AND DIES of intricate design are made by a new process that electroforms iron against the original pattern in deposits up to ½ inch thick. Molds for most anything from a tire to a plastic brooch can be made economically, and in exact duplication of the pattern, by the "Ekko" process. United States Rubber Company Laboratories, Detroit.

• FINDINGS of the National Silicosis Conference on preventing silicosis in foundries have been analyzed by the Division of Labor Standards of the U. S. Department of Labor in a pamphlet that outlines some of the proved means of reducing the silica dust hazard. 10¢. Superintendent of Documents, Washington, D. C.

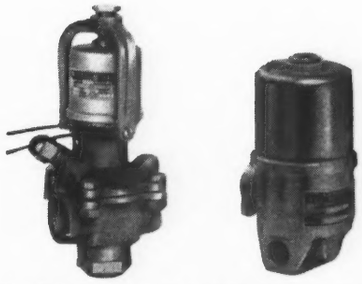
How to do it?

These G-E developments may lead to savings in plant management



MEASURES TIME—SAVES TIME

Connected in a motor circuit, this time meter will read motor running hours, tell you when to lubricate machinery. On other machines and conveyor belts it can be used to indicate where to save time—to save money. Ask us to send you our time meter publication—GEA-3299.



AUTOMATIC CONTROL OF FLUID MATERIALS

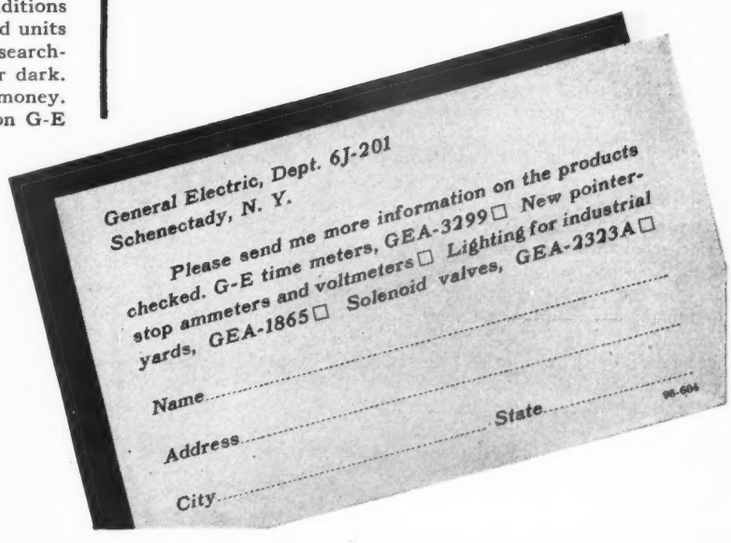
G-E electrically operated valves handle oil, water, refrigerants, low-pressure steam—and practically all clear liquids and gases under pressure—by remote automatic control. And they perform their jobs quickly, easily, cheaply. Our Publication GEA-2323A will tell you more about them.

YARD LIGHTING — PLANT LIGHTING PROTECTIVE LIGHTING

Protect your plants and provide better working conditions with G-E lighting units. There are especially designed units for platforms, for yard lighting—floodlights and searchlights, that help you get more work performed after dark. Use them to protect your plants, to save time and money. Bulletin GEA-1865 will bring you the latest news on G-E floodlights for industrials.

HELPS YOU DUPLICATE WELDS

Get accurate duplication of current in resistance welds when you transfer work from one machine to another—or from laboratory development to plant production by using this new pointer-stop ammeter. It measures welding currents of three or more cycles' duration, permits exact duplication of current conditions. And it's just one of a very complete G-E instrument line. Write us for details.

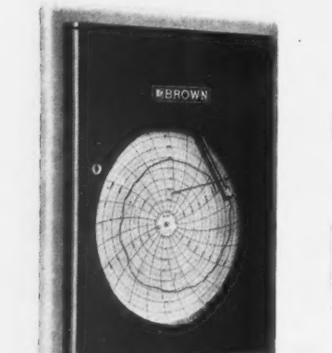

General Electric, Dept. 6J-201
Schenectady, N. Y.
Please send me more information on the products checked. G-E time meters, GEA-3299☐ New pointer-stop ammeters and voltmeters☐ Lighting for industrial yards, GEA-1865☐ Solenoid valves, GEA-2323A☐
Name
Address
State
City
98-604

GENERAL ELECTRIC

What's New in Equipment

Automatic Drill

One-half-inch ball-bearing drills for heavy-duty work have double reduction that is said to keep the offset distance from top of motor housing to center of drill bit at a minimum. The spindle ball bearings take the combined radial and thrust loads. The gears are equipped with 2-pole automatic quick make-and-break safety switch with lock. Motors are fan cooled. The gears are made of heat-treated alloy steels. Frame, gearplate, and gearhead are cast from aluminum alloy. The drill is 15⅞ in. long, weighs 9½ lb., has a no-load speed of 650 r.p.m., full-load speed of 300 r.p.m. Universal motor operates on a.c. or d.c. Jas. Clark, Jr., Electric Co., Inc., Louisville, Ky.



Thermometer and Pressure Gage

Available in 1-, 2-, and 3-pen models, indicating and recording thermometers for temperatures from —40 deg. F. to 1,200 deg. F., and indicating or recording pressure and vacuum gages for ranges from 6 lb. to 2,500 lb. per sq.in., and on vacuum ranges of 10 in. of mercury and over, are constructed with heat-treated actuating elements to insure permanent calibration. The chart is secured to the driving mechanism by tapered stud and tapered chart positioning stud. Safety link between actuating element and pen provides an overload safeguard protecting mechanism if pen is moved manually. Longer pen arm, (8 in.) permits pen travel of 4¾ inches. A flat subplate with 3-point resilient suspension mounting carries the moving parts. The adaptor block is designed to facilitate removal of actuating element for replacement or change of range by user. The Brown Instrument Co., 4461 Wayne Ave., Philadelphia.

Speed-Changer Unit

Unit consists of a variable-speed drive with top casing on which is mounted an adjustable base which supports a standard motor connected to the unit by V-belts. Base may be adjusted by a jack-screw device which enables center distance of drive to be adjusted to maintain tension. Available in 10 sizes with maximum rating up to 75 horsepower and variable ratios up to 3 to 1. Allis-Chalmers Mfg. Co., Milwaukee.

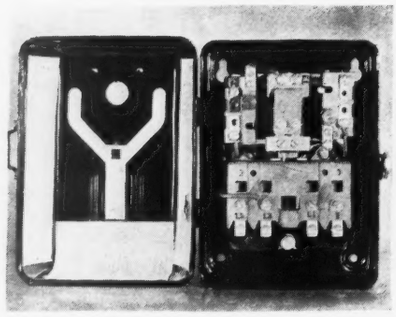
Engine

Model 800G is a single-cylinder, 5.5-hp. engine, especially suited for pumping jobs where horsepower requirements are low. It is aircooled, and has unusually large lubricating oil pump so that it can run for long periods without attention. It is a four-cycle vertical engine with full-load speed range of 800 to 1,800 r.p.m. Can be run on gas or gasoline. Caterpillar Tractor Co., Peoria, Ill.

Welding Electrodes

Four electrodes, each having physical and chemical characteristics for particular uses, are said to be alloyed to meet the demand for tough abrasion-resisting materials for the original surface maintenance and repair of metal parts subject to excessive wear, and to inter-alloy with the base metal when applied by the metallic-arc method. Page Steel & Wire Div., American Chain & Cable Co., Inc., Monessen, Pa.

Linestarter



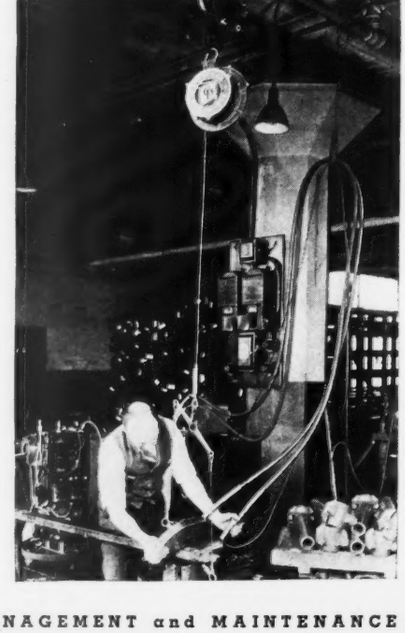
Linestarter, for ratings up to 2 hp., 220, 440, 550 volts, 2- and 3-phase (equivalent ratings on single-phase) are used for across-the-line starting of squirrel-cage induction motors, and as primary switches for wound-rotor induction motors. Typical applications include machine tools, conveyors, and pumps. Feature De-ion arc quenching and snap-action bimetallic-disk overload relay. Available as across-the-line starters and in combination with motor circuit switches and Nofuze circuit breakers in standard inclosures. Westinghouse Electric & Mfg. Co., East Pittsburgh.

Fluorescent Lamp Reflector

"Reflecto-Duct" is a reflector for fluorescent lamps. Made for 18-, 24-, 36-, and 48-in. lamps, one- and two-tube models. Made of heavy-gage spot-welded steel, the reflectors are bonderized before enameling. Open ends allow continuous trough lighting. Reflectors, Inc., 3225 Frankford Ave., Philadelphia.

Balancer

CP Super Safety Balancer features a retainer-inclosed spring; automatic safety lock which acts in case of spring breakage; time-saving drum lock which holds load so that the spring or cable can be changed; automatic cable lock to prevent overwind-



"TO THINK I'D O.K. A REQUISITION FOR A LOT OF SHOESTRINGS!"

That Was What One Paper Plant Superintendent Said Six Years Ago! But Today Texrope Drives Are Standard Equipment in His Plant . . . Providing Positive, Slipless Transmission . . . Saving Money Every Day! Read About Texrope Drives . . . Your Way to Lower Transmission Costs!

ONE OF TEN TEXROPE DRIVES IN A LARGE eastern paper plant, this 125 hp drive has been in continuous 24-hour operation since March, 1933, without any cost for replacements . . . is expected to go on giving 100% service for a long time to come!

The plant superintendent came in, took one look at workmen installing a Texrope Drive, and said—"To think I'd O.K. a requisition for a lot of shoestrings!"

That was six years ago in the plant of an eastern paper manufacturing company. And apparently the superintendent didn't think much of the first experimental lot of Texropes put on a beater in his plant.

But wait—read what happened next! They found that the "shoestrings" really stood up . . . even under the stress of 24-hour operation, day in and day out! Moreover, they found the Texrope Drive handled the beater as no other drive had ever done before —quietly, efficiently, with no slip or jerk, and not a penny spent for replacements!

That's why the superintendent now grins when he thinks of that day six years ago when he called them "shoestrings." For today Texropes are standard all through his plant. And every one of those original Texrope belts is still giving 24-hour a day service . . . beating transmission maintenance costs . . . making real savings!

You Save With Texrope!

Best of all — today, with new, important improvements, you get even better belt performance. For when you use Texropes, you get belts made with a new, special, cool-running rubber compound that gives longer life than ever before. What's more, they are sold in scientifically matched sets for equal pulling and long, even wearing.

To find out the power transmission savings that Texrope Drives bring you, get in touch with the nearest Allis-Chalmers district office or representative. Or write direct to Allis-Chalmers for money-saving facts.

A-1138

Vari-Pitch Speed Changers • Texrope V-Belts • Duro-Brace Texsteel Sheaves • Vari-Pitch Sheaves • Standard Cast Iron Sheaves • Adjustable Pitch Diameter Texsteel Sheaves • 2-3-4 Combination Sheaves • Straitline Automatic Motor Bases • Oil Field Drilling Rigs

Belts by Goodrich

TEXROPE DIVISION

ALLIS-CHALMERS

MILWAUKEE · WISCONSIN

ing of cable up or down; cable guide for keeping cable in line with the drum groove and for preventing jumping; safety hooks with top hook arranged for lateral screw adjustment to insure centering of cable and load; spring adjustment through hardened worm gear and pinion. Outside mounting is said to permit largest possible diameter spring in any given balancer capacity. Used for lifting, suspending, and balancing of portable tools or objects weighing up to 200 lb., the balancer is available in 15 sizes. Chicago Pneumatic Tool Co., 6 East 44th St., New York.

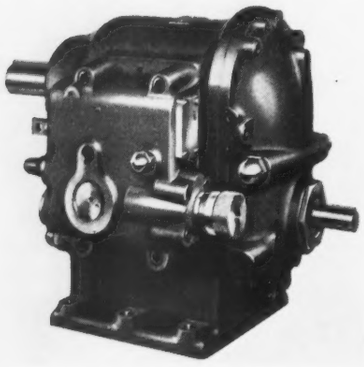
Wiring Devices

Weatherproof wiring devices, for single-gang installation in creameries, distilleries, loading platforms, are designed to resist corrosion and short circuits due to moisture. Switches are "T" rated for Type C lamp loads. Plates are 0.06-in. brass with baked-on aluminum finish. Each device is sealed with cover and plate gaskets. These devices may be installed in a single-gang switch box or flat-face, square-corner FS fitting. Outlet rating: 15 amp., 125 volts; 10 amp., 250 volts. Pass & Seymour, Inc., Solvay Station, Syracuse, N. Y.

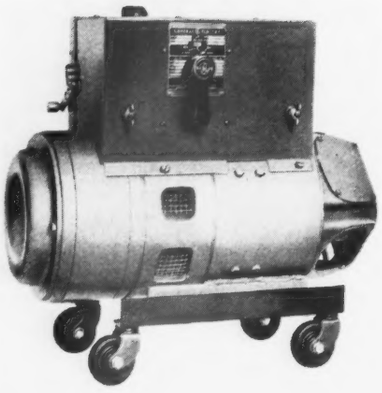
Merger

Chain Belt Company, Milwaukee, has acquired the business and net assets of the Baldwin-Duckworth Chain Corporation, Springfield, Mass. The plants of the latter at Springfield and Worcester, Mass., will retain their identity and be known as Baldwin-Duckworth Division of Chain Belt Company.

Variable-Speed Transmission



Hydraulic variable-speed transmission is a 2-hp. unit for machine tool and other applications. Provides speed range steplessly variable from 10 to 3,000 r.p.m., and is suitable for either speed or feed drives. Multiple piston pump is mounted below an oil power fluid motor of the same type. Simple and flexible mechanical, hydraulic, or electrical control can be provided. High starting torque at low speeds and no power loss in accelerating from standstill to maximum speed or in starting and stopping, are claimed. No valves are used in reversing. Sundstrand Machine Tool Co., Rockford, Ill.



Arc Welder

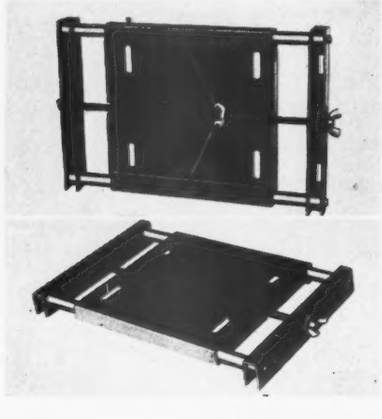
The 150-amp., d.c., single-operator arc welder, requiring approximately 2½ sq.ft. of floor space, features low center of gravity, horizontal construction. Portable set is 4 in. higher than the stationary set which stands 20 in. high and is 27 in. long, 12 in. wide. By using the 3-point selector switch and a dial for intermediate adjustment, any welding current within the welder's 20- to 200-amp., 25-volt range of adjustment can be obtained, it is said. Isothermic overload protection is provided to insure against burnouts. Manual line switch is used in starting. Rated output is 150 amp. at 25 volts. Power supply: 220 or 440 volt, 2 or 3 phase, 60 cycle. Also available is an a.c. arc welder, transformer type, 100- and 200-amp. sizes. General Electric Co., Schenectady, N. Y.

Gas-Fired Unit Heaters

Line of gas-fired unit heaters consists of four capacities in unit heaters and six capacities in dust heaters. Slow-speed rubber-mounted motors result in quiet operation, it is said. There are floor units also. Capacities range from 55,000 to 150,000 B.t.u. per hr. input and 45,650 to 124,500 B.t.u. per hr. output on the unit heaters; 55,000 to 300,000 B.t.u. per hr. input and 54,000 to 240,000 B.t.u. per hr. output on the duct heaters. Carrier Corp., Syracuse, N. Y.

Motor Base

Steel motor base, designed to automatically maintain correct belt tension through steel springs, is particularly suited to short center drives. It is said to be applicable to horizontal, vertical, or overhead drives; pulsating, steady, or reversing loads. By turning the adjusting screw, the base is moved back to give desired belt tension. Spring tension holds the motor, takes up slack, cushions load shock. When installed, the motor is mounted directly on the sliding plate, and motor and base are bolted down as a unit. With spring tension released, belt can be changed. Ideal Commutator Dresser Co., 1416 Park Ave., Sycamore, Ill.



Circuit Breaker

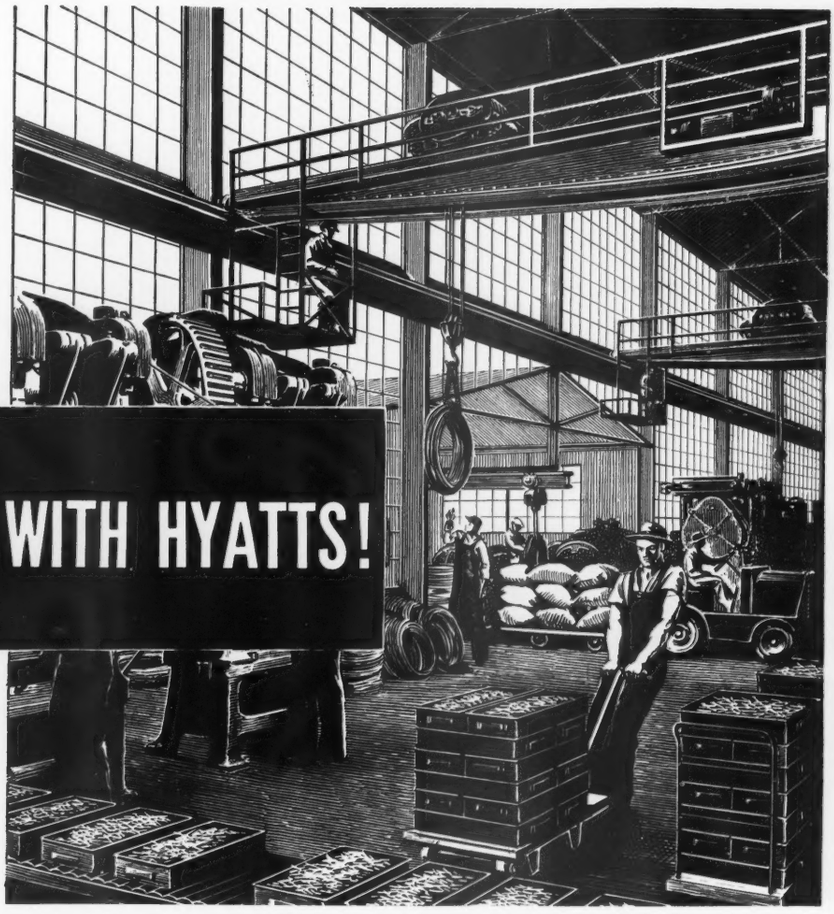
Multi-breaker, Type MO, for 230 volts or 115-230 volts, 2-pole or 3-pole solid neutral, is equipped with an operating handle which indicates "on," "off," or "tripped," and which cannot, it is said, be held closed against a short circuit or overload. Movement of handle restores current after cause of interruption has been removed. The unit is supplied fastened to the cover of the box. Once installed, the cover need never be removed, it is claimed. Live parts are covered. Available in flush or surface mounting with capacities of 15, 20, or 25 amperes. Box can be furnished with grounded neutral, insulated (groundable) neutral, or no neutral. Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.

Stirrup-Type Fire Escape

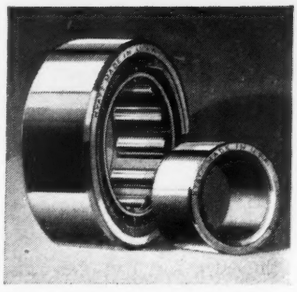
All-metal, portable, stirrup fire escape can be anchored, for industrial use, in elevator towers for climbing into elevator lofts, to the wall of a building, to the top rim of a tank for inside or outside tank work. The steps are of stirrup design and are fastened to the side chains in 4 places. The side chains are said to be able to hold 1,880 pounds. Steps and chains are electric galvanized. Available in 3 lengths: 16-ft. unit, weighing 20 lb., for 2-story buildings; 24-ft. unit, weighing 28 lb., for 3-story buildings; 32-ft. unit, weighing 38 lb., for 4-story buildings. Engineering Development Co., Grand Rapids, Mich.

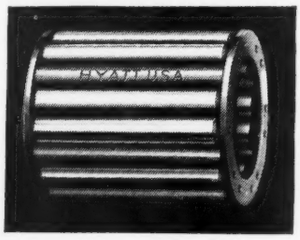
Twin-Filter Respirator

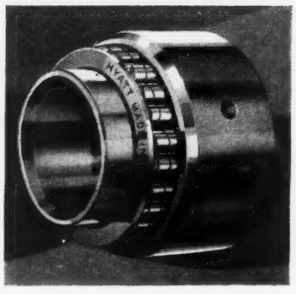
Twin-filter respirator, said to have 40 sq.in. of filtration area, is for protection



Alive WITH HYATTS!







In every modern mill or factory . . . busy cranes, hoists, trolleys, conveyors, trucks, and trailers feeding hungry machines . . . hauling away their finished products. Material handling equipment of every make and kind *alive* with Hyatts . . . alert to industry's needs in the Whirl of Today and Tomorrow . . . chalking up new high marks of efficiency, economy, and long life . . . always on the go with Hyatts. Specify these better bearings by name. Hyatt Bearings Division, General Motors Sales Corporation, Harrison, New Jersey; Chicago, Pittsburgh, Detroit and San Francisco.

HYATT *Roller Bearings*

WALKWAYS "Tailor-Made" FOR YOUR PLANT

Quickly Constructed with the NEW Expanded Metal WALKWAY MESH

Steelcrete

YOU CAN have catwalks, gauge walks and window walks where you want them and as you want them when you use Steelcrete Expanded Metal Walkway Mesh. This strong, easily fabricated material with its small diamond openings can be "tailor made" on the job to fit perfectly around pipes or other obstructions. Trap doors and other openings can be cut from this material wherever they are needed. Easy to erect and easy to alter, Expanded Metal is also a better diffuser of light. Its diamond openings never create "blind spots." Available plain, painted or galvanized in several sizes of sheets, stair treads, walkway grilles, platforms, etc. Also may be purchased prefabricated, if preferred. Write for new literature today.

Even screw drivers cannot fall through the new Steelcrete Expanded Metal Walkway Mesh.

"IT'S WHEELING STEEL"

THE CONSOLIDATED EXPANDED METAL COMPANIES
WHEELING, WEST VIRGINIA
Branch Offices and Warehouses:
New York • Chicago • Detroit • Cleveland • Pittsburgh • Philadelphia • Boston • Buffalo • Houston • Atlanta
Export Office: 330 West 42nd St., New York, N. Y.

against Type A Pneumoconiosis- or Silicosis-producing dusts. Filter-retaining plates are eliminated—the filters being held in place by adjustable tubular connections. Sewing the filters together and turning them inside out before attaching them to the facepiece is said to make it impossible for them to choke or collapse thereby facilitating free breathing. Two check valves and an exhalation valve are provided to prevent collection of moisture and rebreathing of stale air. The facepiece is rubber and is made to fit air-tight. A face cloth gives protection against dermatitis. There are no metal parts in the construction. H. S. Cover, Chippewa St., South Bend, Ind.

Model 203 "Acousti-Booth" has a plywood interior (walls and ceiling) perforated with a pattern that is said to absorb noise into a sound-suppressing inner wall. Built without a door and open around the bottom, the booth does not require special ventilation. Burgess Battery Co., Acoustic Div., Dept. NR, 500 West Huron St., Chicago.

Thermostat

T0900 "Grad-U-Stat" is a pneumatic thermostat for either duct or wall mounting. Has no leakport and uses air only when it is changing position of an air motor or valve. May be used as direct- or reverse-acting thermostat, and the throttling range of differential may be adjusted between comparatively wide limits. Minneapolis-Honeywell Regulator Co., 2950 Fourth Avenue, S., Minneapolis.

Spray Painting Unit

Portable spray painting unit features forced draft cooling of the compressor. Two powerful fans set up a suction and blowing system within the confines of an inclosed metal case. The intake and exhaust vents are so designed to permit entrance of cooling air and passage of this air completely around all parts of the unit before it is exhausted. The compressor is about the size of the average portable electric sewing machine and roughly

Power to Speed Up

Dozens of Tough Hammering Jobs

Wherever a hammering action is needed—you'll find a Van Dorn Portable Electric Hammer to speed up work, cut down costs and make jobs a lot easier, too! For these **POWERFUL**, perfectly balanced, rugged tools produce hundreds of lightning-fast "follow through" hammer strokes per minute that make quick, easy work of tasks which are slow, laborious and costly when done by hand.

Being completely self-contained, these versatile tools can be used for hundreds of different jobs. Here are a few: Drilling anchorage holes or foundation beds for heavy machinery; drilling or channeling in concrete, stone or brick; opening walls or partitions; demolition work; chipping out rust from boilers and boiler tubes; chipping heavy castings; installing new signs, equipment, fixtures; shaping wood beams and timbers. The Van Dorn Hammer line consists of 4 units. One of these will fit your requirements.

Don't put it off—ask your Jobber today to show you the advantages of Van Dorn Portable Electric Hammers. Let him prove how they can pay their own way in your shop. Van Dorn Electric Tools (Division of Black & Decker Mfg. Co.).

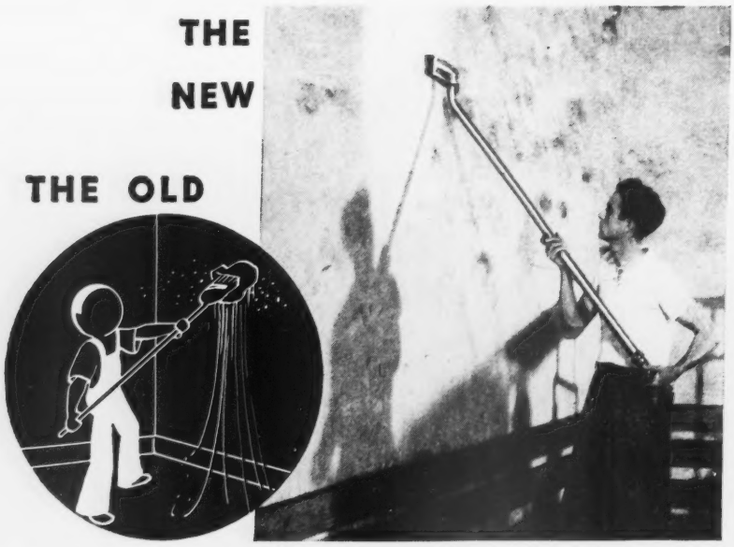
FREE BOOK—Just off the press. A marvelous text and instruction book on the construction, operation and application of Portable Electric Hammers. No obligation. It's yours free. Write to: Van Dorn Electric Tools, 719 Joppa Road, Towson, Md.

"Van Dorn"

THE "RED-HEADED" PORTABLE ELECTRIC TOOLS

THE NEW

THE OLD



Cleaning Wall in Southern Tobacco Factory

Yesterday's Dirt is Today's Dust

And **dust** is far more injurious to health, to goods in process, and can slow up production more seriously than dirt or debris, when it lodges in the wrong place.

Why not remove the dirt and litter as fast as it is produced and eliminate the source of dust? Why not have your plant as clean as a watch or a radio factory? In the long run it costs no more.

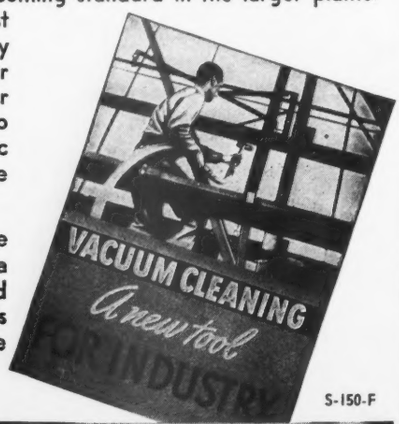
In fact, with Spencer Vacuum you can get top cleanliness at rock bottom costs. Here are some of the estimated savings reported: 25% on cleaning large floor areas; 50% on walls and overhead; 70% saving on the cost of cleaning machinery.

And because of the greater degree of cleanliness you practically eliminate rejects due to dirt, and you reduce fire, health and explosion hazards with every stroke of the powerful vacuum tool.

SPENCER STATIONARY VACUUM SYSTEMS

piped like compressed air or water are becoming standard in the larger plants. Smaller companies and those desiring to test its advantages first are using Spencer Heavy Duty Portables. There's a little ¾ H.P. unit for light service. For ordinary debris, the Spencer 1½ H.P. unit is a favorite. Other units up to 7½ H.P. with dirt capacities up to 7½ cubic feet will meet your requirements in both price and performance.

444 users have been surveyed recently. The reports of their experience, together with a description of the various Spencer Units and a complete variety of industrial vacuum tools are given in Bulletin No. 120F—yours for the asking.



S-150-F

SPENCER HARTFORD

CENTRAL AND PORTABLE VACUUM CLEANING SYSTEMS

THE SPENCER TURBINE COMPANY, HARTFORD, CONN.

the same general shape. Over-all weight is around 40 lb. and a single handle on top of the unit permits handling as easily as one could carry a traveling bag. Case is of heavy-gage steel built to withstand rough usage. Powered by a universal motor. The Binks Mfg. Co., 3114–40 Carroll Ave., Chicago.

Face Shield

Face shield combines 3 types in one. Spark-deflector, fiber, forehead guard may

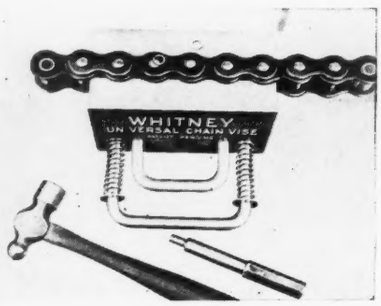
be fitted (1) with an aluminum-bound plastacele window (light, medium, or dark green, or amber) for spot, flash, or gun welding, and for buffing, polishing, wire brushing, die casting, flying scale; (2) with wire screen window for babbitting, heat protection; (3) with fiber front and glass holder for acetylene welding, burning, scarfing. The windows button on the forehead guard. Leather sweatbands are backed by wool felt to absorb perspiration. When not in use the window can be tilted upward. The Boyer-Campbell Co., 6540 Antoine St., Detroit.

Attachment Plugs

C&E safety attachment plugs are made with the blades fitted into a hard rubber insert which fits into a rubber jacket that has a flexible shank designed to take the wear off the cord. The baked lacquer finish is said to be flexible, and oil and grease resisting. To remove tension from connections and permit "yanking" the plug from the receptable, the plugs are made with cord-grip clamps. Available in 2 types: 15 amp., 125 volts; 10 amp., 250 volts. The Ericson Mfg. Co., 5716 Euclid Ave., Cleveland.

Chain Vise

Universal chain vise, developed to simplify installation and repair of cottered-



16 YEARS ON THE JOB

—and it's still going strong!

YOU CAN DO IT BETTER WITH GOODYEAR RUBBER

IF YOU have ever had a conveyor belt fail prematurely from the effects of mildewing—the cancerous soft spots that rot through the carcass in mine operations where there is considerable "stand-by" time—you can profit from the following case history:

In 1923 The Hegeler Zinc Company of Danville, Illinois, needed a new belt for their coal conveyor running from the company's mine to the furnaces and called in the G.T.M.—Goodyear Technical Man.

Finding that this belt would operate only 4 to 6 hours daily, four or five days a week—*standing by the rest of the time*—the G.T.M. specified a Style "W" conveyor belt built with Goodyear's exclusive mildew-inhibiting friction.

This belt is still in operation today—after 16 years of service in which it has handled well over a million tons of coal. It has never required any repairs or maintenance expense. It shows no sign of mildew attack—despite the high percentage of "stand-by" time—and is still in good condition.

This special mildew-resisting construction is only one reason why Goodyear conveyor belts hold the world's tonnage records in handling both anthracite and bituminous coal—*why they give lowest cost-per-ton service!* To get the full story from the G.T.M., write Goodyear, Akron, Ohio, or Los Angeles, California—or phone the nearest Goodyear Mechanical Rubber Goods Distributor.

Centennial of Charles Goodyear's discovery of vulcanization

THE GREATEST NAME IN RUBBER

GOODYEAR

SCOTCH ADHESIVE TAPES

(PRESSURE SENSITIVE—SEAL WITHOUT MOISTENING)

Are the Tapes To Use for Industrial Masking

Where in Your Plant Can You Save by Masking?

Others have found that Scotch Adhesive Tapes have saved time and materials.

You, too, can make savings when painting by masking two-tone jobs—masking name plates—masking vents. In addition, there are other convenient uses such as holding materials together—sealing—reinforcing and splicing.

There are over sixty Scotch Adhesive Tapes for industrial use made in crepe or flat backings of various thickness and strength and a wide range of adhesive properties to meet your specific requirements.

Write for a sample roll.

Made and Patented in U. S. A.

MINNESOTA MINING & MFG. CO.

Saint Paul Minnesota

The Desire To Serve — The Ability To Produce

Under one or more of the following U. S. Patent Nos.: 1779588, 1856986, 1814132, 1895978, 1959413, 1954805, 2156380 Re. Nos. 18742, 19128

Canadian Manufacturers and Distributors
Canadian Durex Abrasives, Ltd.
154 Pearl Street, Toronto, Canada

MINNESOTA MINING & MFG. CO.
SAINT PAUL, MINNESOTA

Dept. FM1039

Gentlemen:
We would like to use tape for.....

Please send sample roll.

Name.....

Company.....

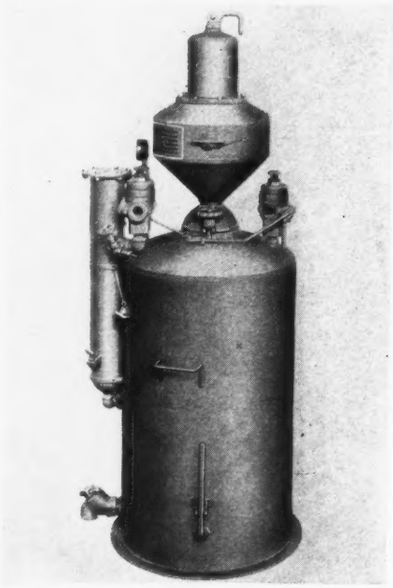
Address.....

City..... State.....

or riveted-type roller chain in pitches from ⅝ to 2½ in. inclusive, makes it possible, it is claimed, for one man to use both hands to disassemble a chain at any point without damage to chain parts. Advantages claimed are: roller chain rivet heads are removable washer-like by hammering the heads to force them through the plate and shear them off; chain need not be removed from sprockets since spring tension will hold tool in position and weight of vise is sufficient to act as an anvil; vise-jaw support at 4 points on each link chain eliminates need of tilting so that pressure against the rivet head is evenly distributed and distortion of pin and plate is avoided; can be used on multiple-strand roller chains, and for riveting new links in place. The Whitney Chain & Mfg. Co., Hartford, Conn.

Acetylene Generator

Portable, medium-pressure, acetylene generator, Oxweld MP-9, operates automatically after starting. One handle is used to start or stop generation of the acetylene and to adjust delivery pressure. Fea-



tures claimed are: 2 relief valves for the generating chamber and for the hydraulic back-pressure valve; hydraulic back-pressure valve to prevent carry-over of water to hose and to check any reverse flow of gases; interference mechanism to allow only proper sequence of operations during recharging. The generator weighs 129 lb.; has capacity of 25 lb. of size 14 ND Union Carbide; has rated delivery as high as 50 cu. ft. of acetylene per hour at pressures up to 15 lb. per square inch. One charging is said to be good for several hours of continuous welding or cutting in all but the heaviest work. The Linde Air Products Co., General Publicity Dept., 205 East 42d St., New York.

Toolpost Grinder

"All Purpose" toolpost grinder is mounted on lathe toolpost on a spherical

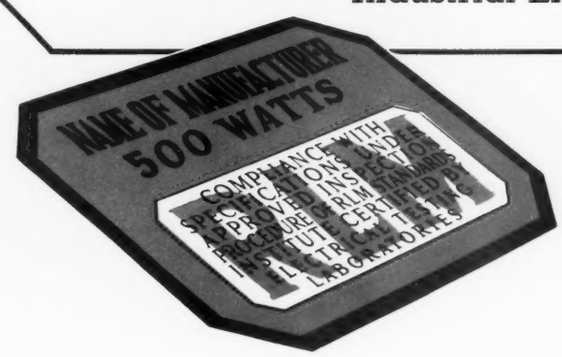
Announcing

HIGHER LIGHT REFLECTION and OUTPUT

Specifications for the

RLM DOME REFLECTOR

The most universally used of all Industrial Lighting Reflectors



Again—More Light at NO EXTRA COST

As a result of careful engineering study, research and tests, the RLM Specifications for light output efficiency in the RLM Dome Reflector again have been increased. Thus the RLM Label on industrial lighting reflectors becomes of even greater value in assuring the purchaser of MORE LIGHT AT NO EXTRA COST.

The new RLM Specifications establish a new high mean reflection factor for the porcelain enamel reflecting surface and a new total light output factor of 78%! All RLM Dome Reflectors now being manufactured meet with these new high efficiency specifications.

This announcement is particularly important because it concerns the Dome type lighting reflector. This reflector because of its special characteristics and wide application for the Better Lighting of plants, warehouses, platforms, docks, etc., is the most frequently used reflector in modern industrial lighting.

Important factor in the popularity of the RLM Dome Reflector is the fact that it is an all-porcelain enameled reflector. Porcelain Enamel's high lighting efficiency, high diffusion and light distribution, durability and long life have made it the most practical and most satisfactory of all known reflecting surfaces for most industrial lighting purposes. Porcelain Enamel Reflectors have been proven by decades of use. They are unaffected by atmospheric conditions obtaining over practically the entire range of industrial processes. Non-porous, easily cleaned and restored to original efficiency, fade-proof, and non-peeling, Porcelain Enamel Reflectors made in accordance with RLM Specifications assure not only highest lighting efficiency but lowest maintenance costs.

For a complete discussion of the four essentials of proper Light Conditioning assured by the RLM Label, (1) Balanced Lighting; (2) Low Cost Maintenance; (3) More Light at No Extra Cost and (4) Warranty of Uniform Quality, you are invited to write for a complimentary copy of the Booklet "The Meaning of the RLM Label."

The letters RLM stand for Reflector and Lighting Equipment Manufacturers

RLM STANDARDS INSTITUTE
INCORPORATED

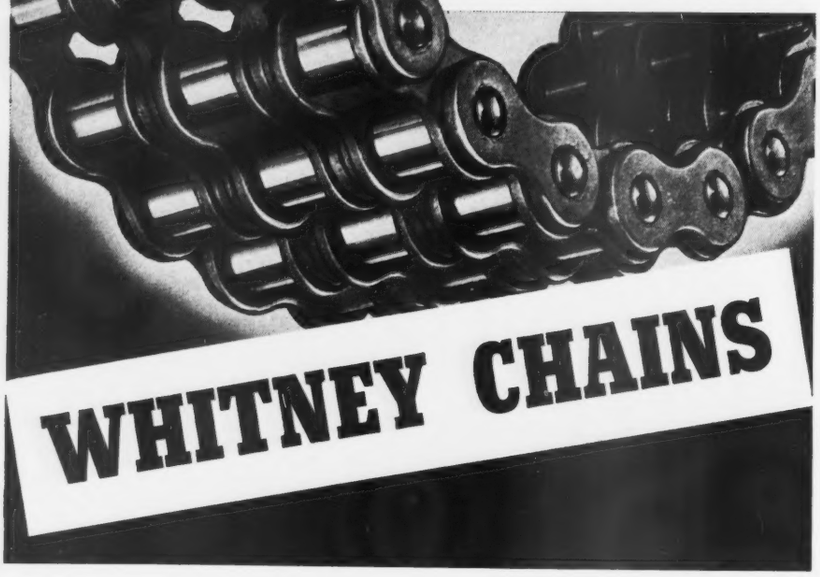
20 N. WACKER DRIVE • ROOM 1130 • CHICAGO, ILL.

THE CERTIFICATE OF RLM UNIFORM QUALITY

FOR "Value Received" FROM POWER

You get more of what you pay for . . . when the power you buy goes to work thru Whitney Chains. Top productive capacity of your machines is consistently maintained . . . as is product-uniformity. And your chain costs themselves will be kept down by Whitney's advanced engineering and tough alloy steels. And yet Whitney quality and performance add no premium to price. So investigate the profit-opportunities that may well be in store for *you. Write for catalog V-115B.*

The Whitney Chain & Mfg. Co.
HARTFORD, CONNECTICUT



WHITNEY CHAINS

radius adapter which enables the operator to adjust the grinder accurately and quickly in any plane and at any angle. Accurate internal thread grinding ability is one of its features. Other features are: Automatic correct belt tension; eight speeds obtainable by switching pulley and sheave, holes in sheave and pulley being the same size; wear easily taken up without disassembling; standard surface grinder wheels fit the spindle; for certain jobs the wheel can be placed on the drive end of the spindle; motor is dynamically balanced; motor and bearings are completely inclosed; a wick felt keeps spindle well lubricated. One oil hole cares for the entire spindle. Can be used on milling machines, shapers, planers, as well as on lathes. R. G. Smith Tool & Mfg. Co., 245 South St., Newark, N. J.

Waste Receptacle

"Onliwon" welded-steel waste receptacle which stands 30¼ in. high, is 11½ in. wide, and 5½ in. deep, has a small opening on

top to encourage users to wad or fold their towels and place them in the receptacle rather than throw them at the opening. The receptacle can be hung on a wall as well as placed on the floor. Hinged door at the bottom facilitates emptying. A. P. W. Paper Co., Albany, N. Y.

Diesel Generator Set

Diesel generator set has two-cylinder engine with a 5 to 7½ kw. generator. It is intended to supply light and power for small plants, or to handle lighter night loads and act as a standby for light and power. The engine is also sold separately as a small power unit. Hill-Diesel Engine Co., Lansing, Mich.

Mechanical Compounds

Line of colloids compounded for mechanical purposes includes a high-temperature lubricant, high-temperature joint compound, plastic gasket, and a packing compound. The packing compound, for application on fibrous or metallic packing, is said to assist in glazing off the packing

These Vials tell the Rice Process Story...

VIAL A contains refined linseed oil as commonly used in white oil paints. Mixed with white pigments, the oil *seems* to lose its color. BUT *the yellow is still there!* Sooner or later, it will show up on your painted walls and ceilings.

VIAL B shows how the same oil appears after treatment with our own secret Rice Process. It is almost pure white in color. *The yellow is removed!* This exclusive process is the reason why we can blend synthetic vehicles with our processed oils and give you in the new Barreled Sunlight a paint that is (1) whiter to start, that (2) holds its whiteness longer, (3) dries quicker, (4) gives increased spreading and hiding properties and (5) flows more easily.

AGAIN the Secret Barreled Sunlight Process MAKES NEWS!

Unmatched for 25 years, Barreled Sunlight is FIRST again because of the exclusive Rice Process . . . FIRST to develop a *really practical* quick drying paint for large areas . . . a paint that is *even whiter* and holds its whiteness *still longer*

Now there's an amazing new Barreled Sunlight . . . the result of combining newer synthetics and modern pigments with the famous secret Rice Process of treating linseed oil.

Barreled Sunlight is now whiter than ever before . . . and it holds its whiteness even longer. But of equal importance, spreading and hiding powers have been increased so that less paint is needed for any job. And because this better Barreled Sunlight flows easier . . . permits painters to work faster and cover more space . . . it's a *really practical* quick drying paint for large industrial areas.

Check Barreled Sunlight against any other paint you've ever used . . . and you'll be sold on it for good. It is the *only* white paint that offers you all these advantages, for the secret Rice Process—by which it has retained its leadership for a quarter-century—cannot be copied by any chemist. *It defies chemical analysis!* For details on Barreled Sunlight for industrial use, let us send you a free copy of "More Light with Lasting Cleanliness." Address U. S. Gutta Percha Paint Company, 2-J Dudley Street, Providence, R. I.

BARRELED SUNLIGHT

(WHEN ORDERING, PLEASE SPECIFY "QUICK DRYING FORM")

FOR MODERN EFFICIENCY AND SAVINGS IN

PLANT HOUSEKEEPING

PUT THIS INDUSTRIAL CLEANER ON THE JOB

● This Invincible Suction Cleaner is designed primarily to do a far better job of plant housekeeping than is possible with old-fashioned methods, and at much lower cost! It does just that, and more, as evidenced by its effective use in thousands of plants. It saves time and labor . . . prevents costly damage . . . and greatly improves working conditions.

Consider—

1 that it is not a huge, awkward machine. It is surprisingly light, compact, and easy to use. It even follows the operator by a slight pull on the hose, and this saves lots of time.

2 that despite its unusual portability it is ruggedly built and is designed to "take it"—will actually withstand years of constant, 24-hour-a-day operation if need be.

3 that it has abundant cleaning power for even "tough" cleaning jobs. Any surface from floor to roof is safely and thoroughly freed from dust and dirt. No dust whatever is scattered.

The "Invincible" cleans floors, walls, pipes, beams, shelves, bins, conveyors, and every nook and corner.

● This "Invincible" is already bringing savings and advantages to a majority of the Country's leading manufacturers. Can it do as much for you, too? Drop us a note and get complete information.

INVINCIBLE VACUUM CLEANER MFG. CO.
... 440 DAVIS · DOVER, OHIO

used and to supply a long lasting lubricant in the stuffing box, thus maintaining an effective seal and reducing possibility of scoring. Each type is designated by a formula number and is labeled for the specific purposes and temperatures intended. Industrial Colloids Corp., 1316 West Cermak Road, Chicago.

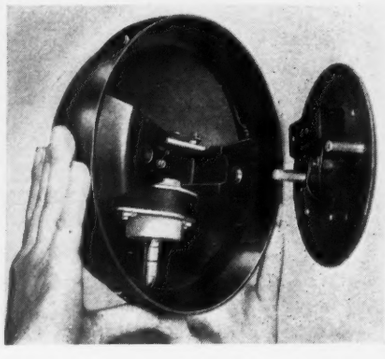
Packing Box

Hopper front of the "Hopr-Seal" box, for packing bolts, nuts, and small parts, per-

mits access to the contents of each box regardless of number stacked, it is claimed. Made of "common run-of-mine stock cans" squared into box shape, the boxes are said to be able to withstand a 300-lb. load without distortion. The Atlas Bolt & Screen Co., 1100-1144 Ivanhoe Road, Cleveland.

Change of Name

General Plastics, Inc., of North Tonawanda, N. Y., has announced a change in its corporate name to that of Durez Plastics & Chemicals, Inc.



Signal and Alarm Bell

"Connectabell" signal and alarm bell features Alnico-magnet motor and plug-in connection. The striking plunger is the only moving unit in the striking mechanism. The motor is inclosed. The bell can be mounted on standard outlet boxes by fastening the detachable backplate to the wall outlet and connecting the wires to the screw terminals. Designed primarily for high voltages, a.c. or d.c., it is also

(*Continued on page* 114)

OIL CONSUMPTION REDUCED 56%
...AN 80% SAVING IN OIL COSTS

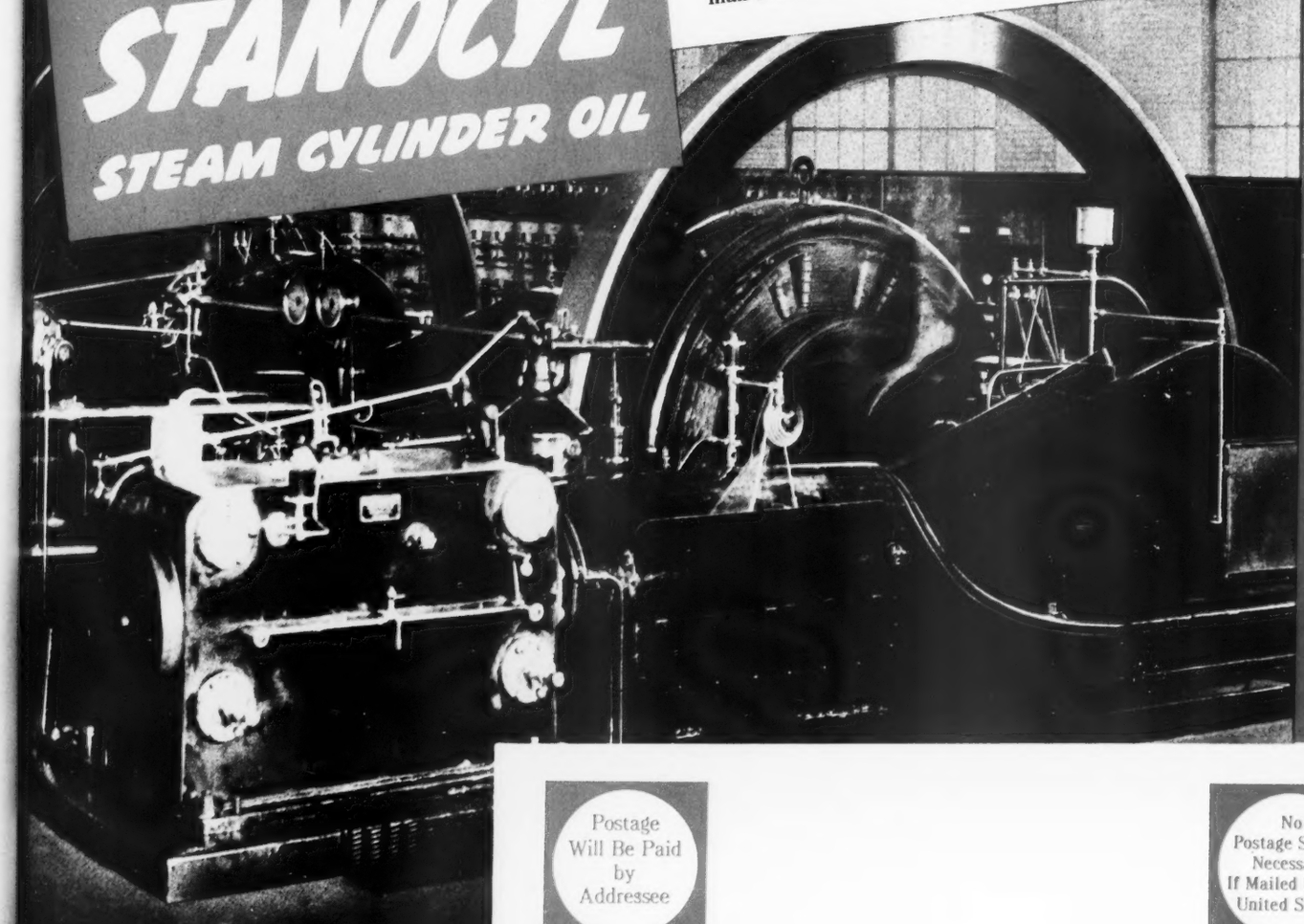
● WHEN StanoCyl was tested on the engine in the foreground, a pint lasted 5 hours and 20 minutes; a pint of the oil formerly used lasted only 2 hours and 30 minutes. Naturally it wasn't long before every unit in this plant was put on StanoCyl.

A 50% reduction in oil consumption is not unusual where StanoCyl Cylinder Oil takes over a plant. Even when it replaces lower priced oils, there is usually a substantial saving in actual oil costs, not to mention the improved lubrication and lower maintenance that is bound to follow. In this Kansas power plant, the test was made against a high-grade, higher priced oil. Actual oil costs were cut 80%.

Regardless of what you now pay for steam cylinder oil, try StanoCyl. Find out if you *are* getting the lowest possible costs, including engine maintenance. A Standard Lubrication Engineer will help you make the test. If you are in the 13 Midwestern States served by these Engineers, call the nearest Standard Oil (Indiana) office or mail the card below.

Copr. 1939, Standard Oil Co. (Ind.)

STANOCYL
STEAM CYLINDER OIL



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FOR FIFTY YEARS
STANDARD OIL (IND.)

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...ON ENGINEERING...LUBRIC

Postage Will Be Paid by Addressee

No Postage Stamp Necessary If Mailed in the United States

BUSINESS REPLY CARD

FIRST CLASS PERMIT No. 252 (SEC. 510 P. L. & R.) CHICAGO, ILLINOIS

STANDARD OIL COMPANY (Ind.)

910 S. MICHIGAN AVENUE

CHICAGO, ILL.

Mr. W. I. Nunn
Room 1217

••LUBRICATION ENGINEERING••LUBRICATION ENGINEERING••LUBRICATION

USE 25% LESS GREASE AT SAGINAW FURNITURE SHOPS

Grease just wouldn't stay in the bronze bearings on the belt sanders at the Saginaw Furniture Shops. Excessive consumption, mechanical trouble, and wasted machine time were a few of the difficulties that followed.

A Standard Oil representative suggested Superla 2X. Read what L. L. Gaines of this company has to say about this test:

> "The trial of your Superla 2X Grease on a few of our sanders convinced us we had found what we wanted. The results have proven out accordingly, giving us perfect lubrication, and over 25% reduction in consumption. We are now using your grease on all of our sanding machines.
>
> "We appreciate your service on this problem, and feel you are entitled to know about the results obtained."

Don't let troublesome bearings bother you. Put the problem up to a Standard Lubrication Engineer. If the right lubrication can correct it, he'll get results. And it won't cost you a cent for his services.

INDICATOR SERVICE AND CLEAN OIL CUT DOWN INSPECTION

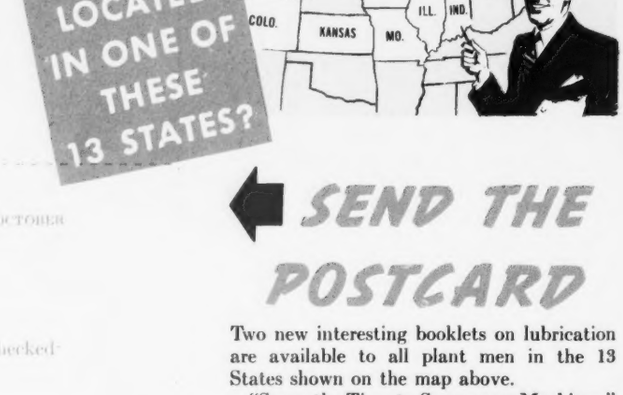
"We could run 10,000 hours between inspections on that oil," said the Superintendent of a Minnesota municipal plant recently, when he found all rings free and practically no carbon after 6,000 hours of operation on Nonpareil Diesel Oil.

Some years ago, after a series of bearing failures, the plant was changed over to Nonpareil. Bearing failures stopped, and at subsequent inspections the superintendent found little or no cleaning needed. He decided to lengthen the time between inspection periods.

A Standard Lubrication Engineer checked these engines from time to time. Indicator cards were pulled

and the necessary adjustments were made to keep these Diesels in perfect condition. With this service and the clean operation of Nonpareil the superintendent now finds inspections unnecessary even after 6,000 hours.

Try that combination in your plant. See if you can't match the records for low Diesel maintenance and operating costs that this service almost invariably brings.



STANDARD OIL COMPANY (Indiana) OCTOBER
910 S. Michigan Avenue, Chicago, Illinois.

Gentlemen: I am in one of your 13 Middle Western States.

☐ Have your Engineer call.

☐ Do not have your Engineer call, but please send me the booklet (s) checked:

- ☐ "Spare the Time to Spare your Machines."
- ☐ "How StanoCyl cuts Oil Consumption."
- ☐ "The Lubrication Engineer—His Value to You."

Name _____ *Position* _____

Company _____

Address _____

City _____ *State* _____

SEND THE POSTCARD

Two new interesting booklets on lubrication are available to all plant men in the 13 States shown on the map above.

"Spare the Time to Spare your Machines," describes the latest development in a highly stable, long lasting oil for many uses.

"How StanoCyl cuts Oil Consumption," should be of interest to all power plant men concerned in the purchase or use of steam cylinder oil.

"The Lubrication Engineer—His Value to You," tells how these Engineers work and what they can do to help you reduce lubricating costs throughout your plant.

Check the subjects that interest you and mail the card. No postage is necessary.

FROM MINIATURE TO

EVERYTHING IN TRANSMISSION: Bearings — Collars — Clutches — Couplings — Contactors — Hangers — Pillow Blocks — Pulleys — V-Belt Sheaves and Complete Drives.

Wood's V-BELT DRIVES

WOOD'S V-BELT DRIVES transmit developed power with minimum loss . . . run smoothly . . . evenly . . . absorb backlash and jerks which prolongs the life of the motor. *Only sheave grooves that are precision machined, accurately spaced and absolutely true, with side walls at perfectly uniform angles can make possible such invariably long-lived, economical performance!*

Our stock assortment consists of nearly 2800 drives, from ¼ h.p. to 100 h.p., with at least a dozen selections of center distances for each drive. **SPECIAL RUSH DELIVERY SERVICE** on emergency jobs—shipment of stock drives same day order received.

T. B. WOOD'S SONS COMPANY · Chambersburg, Pa.

The **BROWNING CRANE & SHOVEL Co.**

ESTABLISHED 1899

Main Office and Factory

16226 Waterloo Rd., Cleveland, Ohio

Export Department

30 Church St., New York, U. S. A.

40 YEARS OF

LEADERSHIP

RAIL
CRANES
SHOVELS
DRAGLINES
ZEE ROTATORS

BROWNING PRODUCTS

DIESEL
GASOLINE
STEAM
ELECTRIC

CRAWLER, TRUCK AND WAGON
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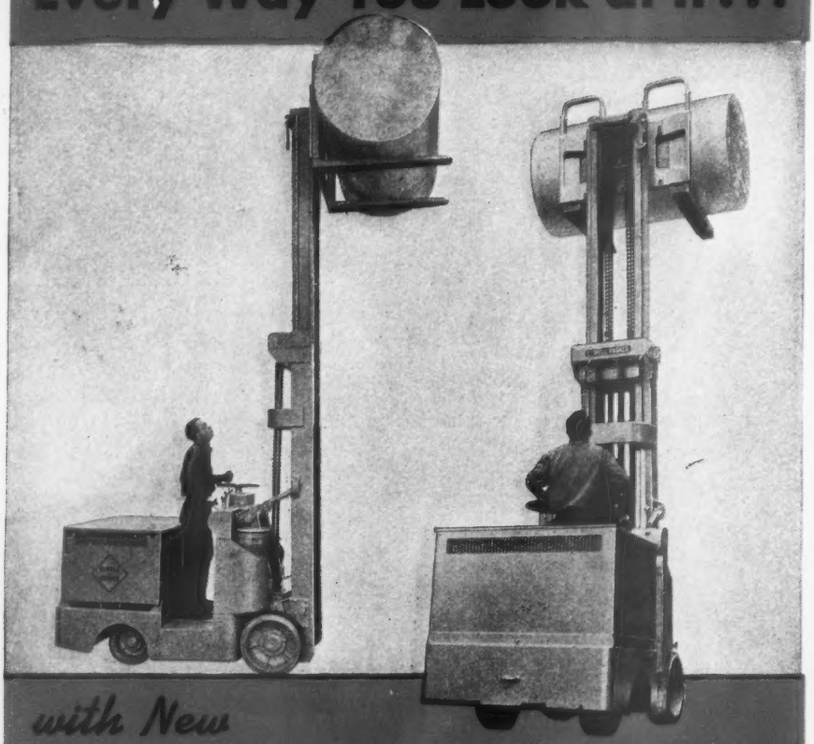
BROWNING PRODUCTS

DIESEL
GASOLINE
STEAM
ELECTRIC

You Win

Every Way You Look at it . . .



with New

Elwell-Parker Center Control Trucks

You win! Elwell-Parker offers new, down-to-the-minute Center Control Trucks in 5 completely separate sizes and capacities. **Choice!**

You win! Center Control design by Elwell-Parker gives operator improved visibility by bringing him closer to his load; by providing increased safety, better control of Truck and load in close quarters. **Adaptability!**

You win! Operating mechanism in all Elwell-Parker Center Control Trucks is identical with same equipment in widely-used, *proven* Elwell-Parker Rear-Control Trucks of corresponding sizes. **Interchangeability!**

Select the Truck best adapted to *your* needs from 10 Standard Elwell-Parker Models, with correct attachments to fit. Write or wire today.

The Elwell-Parker Electric Company, 4323 St. Clair Avenue, Cleveland, Ohio.

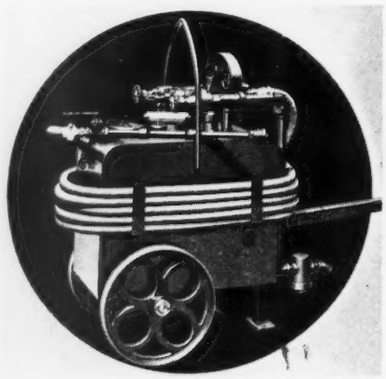
ELWELL-PARKER *Power Industrial* **TRUCKS**

ESTABLISHED 1893 • BUILDING POWER INDUSTRIAL TRUCKS SINCE 1906

made for low-voltage systems. Sizes range from 4-16 inches. Connecticut Telephone & Electric Corp., Meriden, Conn.

Cleaning Jet

High-pressure cleaning jet, for washing plant facilities, pumps, machinery, coils,



floors, stairways, containers, places where dirt, grease, tar, or asphalt collect, is equipped with a 5-ft. insulated tubing to permit the user to stand away from the work and to reach inaccessible places. From an initial steam pressure of 25–100 lb., a jet pressure of 50–250 lb. may be obtained, it is claimed. The equipment includes a 50-gal. boiler-plate solvent tank, occupies a space measuring 18 x 30 in., and is available in portable and stationary models. William Sellers & Co., Inc., Philadelphia.

Power Mica Undercutters

Two types of power mica undercutters. The "Direct Drive Undercutter" is for field or shop use where motor or brush rigging is not removed. The other, the "Shop Type Undercutter," is designed for use on commutators that have been removed, or on jobs where the brush rigging has been removed. The first is a complete unit in itself with a motor and undercutting mechanism encased in light-weight aluminum castings. Anti-friction bearings are used throughout. An adjustable depth gage and roller guide simplifies undercutting of all sizes of commutators both large and small. Slots may be cut to within $\frac{3}{16}$ in. of the commutator riser. The "Shop Type Undercutter" may be purchased complete with undercutter head, motor, flexible shaft and sheath, or the head only. Cuts to within $\frac{1}{4}$ in. of the commutator riser. Standard $\frac{7}{8}$-in. saws or milling cutters with $\frac{5}{16}$-in. holes are used. An air nozzle built into the head keeps commutator free of dust. Ideal Commutator Dresser Co., Sycamore, Ill.

Steel Sheets, Plates

"Silver Ply" stainless clad steel sheets and plates, combining corrosion-resistance of stainless steel with properties of mild steel, are suitable for storage tanks and other equipment used in processing and

ROOFS need SUN-PROTECTION, too!

Sunshine means trouble for many roofs . . . and then someone has to pay the piper! But thanks to its gravel or slag protective surfacing a Barrett Specification Roof is immune to "sunburn" and its undermining effects. This final step in the construction of Barrett Specification *Roofs not only guards against fire and mechanical damage, but also shields the roof membrane against the harmful actinic rays of the sun.

Backbone of a Barrett Specification Roof is Barrett-made coal-tar pitch, the world's greatest built-up roofing compound. This, *plus* Barrett's pitch saturated felt, *plus* the skill and integrity of Barrett Approved Roofers, plus the time-tested soundness of Barrett Specifications . . . all add up to a roof that admits *no equal.*

Barrett Specification Roofs are bonded against repair and maintenance expense for periods up to 20 years and consistently outlive the term of the guarantee, often by decades.

THE BARRETT COMPANY 40 Rector Street, New York, N. Y.
Birmingham, Alabama
2800 So. Sacramento Avenue, Chicago, Illinois
In Canada: The Barrett Company, Ltd., Montreal, Quebec

The nearest Barrett Approved Roofer may be found in the Classified Telephone Directory under "Roofers."

* Trade mark of The Barrett Co., Reg. U. S. Pat. Off.

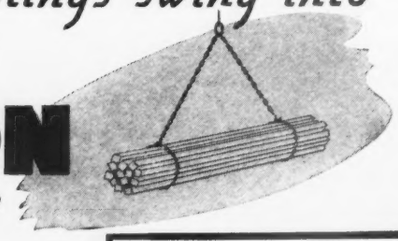
Our Roof Inspection Service will gladly give you a complete, authoritative report on the condition of your present roofs. There is no cost or obligation. Write our nearest office.

Barrett Specification* Roofs

AMERICA'S LEADING MANUFACTURER OF COAL-TAR PRODUCTS • ROOFINGS • TARVIA • CHEMICALS

When your Slings swing into

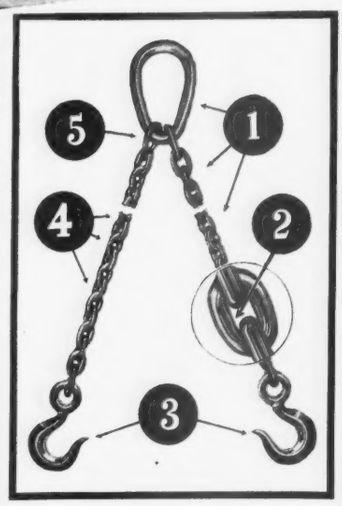
ACTION



WHAT ARE THE SAFETY ODDS?

There's strength to spare—*safe*, enduring strength in HERC-ALLOY Sling Chains. Designed and built by chain experts of Herc-Alloy—one of the toughest metals known to industry—these improved sling chains are winning records for strength and endurance on all types of applications. Just check these highlights:

1. Heat Treated HERC-ALLOY throughout the entire chain for maximum uniform strength.
2. Links are INSWELL Electric Welded by a new process fully covered by Patents.
3. HERC-ALLOY Heat Treated Hooks give maximum strength at these vital points.
4. Short, narrow links reduce to a minimum the danger of bending or gouging when used around sharp corners.
5. All Joiner Links are of Heat Treated HERC-ALLOY. *Descriptive literature on request.*



For Safety Specify

HERC-ALLOY

SLING CHAINS

COLUMBUS-McKINNON CHAIN CORPORATION

(Affiliated with Chisholm-Moore Hoist Corporation)

130 FREMONT AVE. TONAWANDA, N. Y.

Branch Offices: **NEW YORK • CHICAGO • CLEVELAND**

LOOK TO CM

FOR MATERIALS HANDLING EFFICIENCY

No two materials handling jobs are alike! That's why CM *specialized* equipment can mean so much to your plant in terms of stepped-up efficiency, greater safety to men and materials, reduced production costs. Better check into the complete line of CM Materials Handling Equipment—hoists, trolleys, cranes for every type of application. Your dealer will supply you with a catalog—or write us direct.

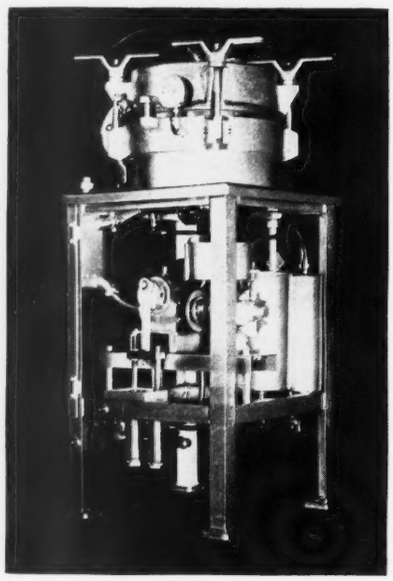
CHISHOLM-MOORE HOIST CORPORATION

(Affiliated with Columbus-McKinnon Chain Corp.)

130 FREMONT AVE. TONAWANDA, N. Y.

Branch Offices: **NEW YORK • CHICAGO • CLEVELAND**

handling varnish, chemicals, soaps, oil, gas, textiles, paper. They are said to be free from "hot spots," to conduct heat, and to be able to be bent, spun into deep heads, deep drawn, and drilled. Oxide-free weld between the stainless cladding and mild steel backing, control of relative proportions of component parts, prevention of carbon particles from migrating to the stainless cladding, are process features claimed. Jessop Steel Co., 527 Green St., Washington, Pa.



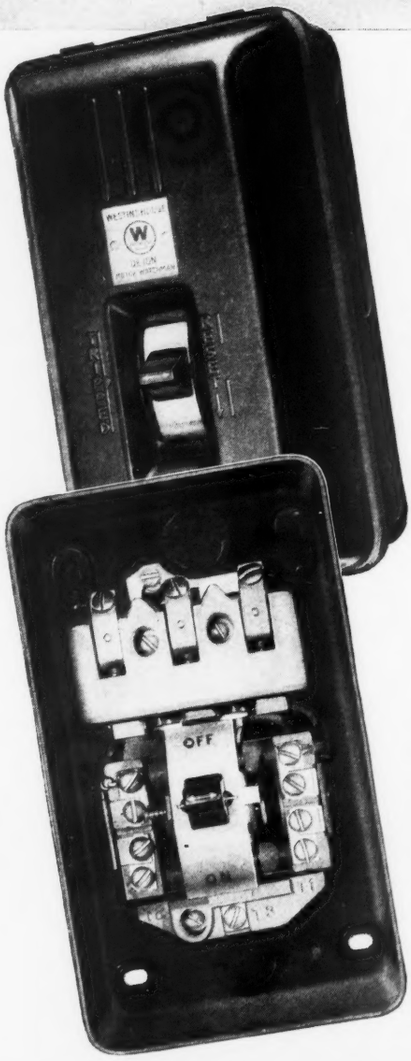
Oil Reclaimer

Model B oil reclaimer—purifying oil from stationary and marine diesel engines, automotive gasoline engines, diesel and gas locomotives, steam turbines, steam engines, air compressors, and vacuum pumps; for purifying non-lubricating oils from transformers, circuit breakers, wire-drawing machines, and hydraulic presses—features continuous, all-electric, and automatic operation. Oil is filtered through a bed of absorbent clay to remove solid matter. Moitsure and fuel dilution are removed by evaporation under vacuum in a vaporizing chamber that is electrically heated and thermostatically controlled. The filter requires cleaning after 22 hrs. continuous operation. The dirty-oil storage tank acts as a storage for drainings as it has capacity for several days operation, it is claimed, and drainings can be poured in at any time. Amount of oil reclaimed ranges from 6–50 gal. per day depending upon type of oil being purified. The Hilliard Corp., 34 West 4th St., Elmira, N. Y.

Fluorescent Lighting Unit

Fluorescent lighting unit, for general or supplementary lighting applications, comes in both single and two-lamp units for either 110-120 or 220-240 volt supply. Steel housing, finished by the Alzak process, completely incloses reflectors, sockets, and controls. The reflector surface has a specular finish for the concentrating-type, two-lamp unit and a diffuse finish for the spread-type, single-lamp units. All hous-

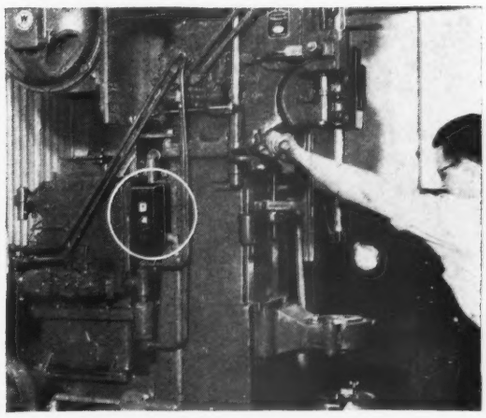
new LOW COST MANUAL STARTER FOR MOTORS UP TO 7½ HP



- Exclusive Westinghouse "De-ion" principle of arc quenching protects contacts from burning or beading when circuit is broken.
- Indicating handle shows clearly whether starter is on, off, or tripped.
- Safety interlock prevents accidental contact with live parts.
- Snap action bi-metal disc relay protects motor from overload.
- Ample wiring space, easy to mount on machine, panel or wall.
- Standard, dust and water-tight, and explosion-proof enclosures.

J-20848

A phone call to your nearest Westinghouse office, electrical wholesaler or industrial agent will bring complete installation data and prices.



WESTINGHOUSE ELECTRIC & MANUFACTURING CO., East Pittsburgh, Pa.

Westinghouse "De-ion" Motor Watchman

W WESTINGHOUSE ELECTRIC

I.Q. for INDUSTRIAL EXECUTIVES PLANT SUPERINTENDENTS PRODUCTION MANAGERS

★1 LUBRICATING OIL IS AN UNNECESSARY INDUSTRIAL EXPENSE.
☐ True? ☐ False?

★2 VIBRATION CONTROL IS UNNECESSARY FOR ECONOMICAL PRODUCTION.
☐ True? ☐ False?

KORFUND VIBRATION CONTROL

Even an apprentice knows that statement No. 1 is false. But how many responsible factory executives know that statement No. 2 is also false?

Wherever industrial wheels turn, vibration takes unnecessary toll of operating profits. It is as universal as friction; but, unlike friction, vibration losses are too frequently ignored simply because they are not readily apparent. Heat and smoke identify uncontrolled friction. The following are a few tangible results of UNCONTROLLED VIBRATION:

- Too many discards from precision machining.
- High maintenance and repair charges.
- Mistakes and accidents from employee fatigue.
- Complaints and litigation by owners of adjoining property.

In addition to producing wealth, machines have the power of self-destruction. If you believe in curbing that power with correct lubrication you will be interested, also, in

"ELIMINATING VIBRATION LOSSES"

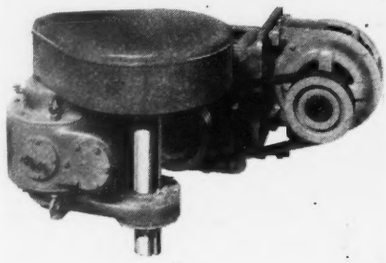
Write for your free copy of this interesting booklet today.

KORFUND COMPANY, Inc.

48-25 THIRTY-SECOND PLACE, LONG ISLAND CITY, N. Y.

More than 250,000 Successful Installations

ings are finished outside with silver gray hammerloid surfacing, and inside with baked white synthetic enamel. Housings on all except the 24-in. units are provided with two-point suspension for attaching to ½- or ¾-in. conduit. Hooks for chain suspension, safe-change hangers, or adjustable swivels for ½-in. conduit are available as accessories. Knockouts are provided in both ends of each luminaire for end-to-end connections to form a continuous light strip. Westinghouse Electric & Mfg. Co., Cleveland.



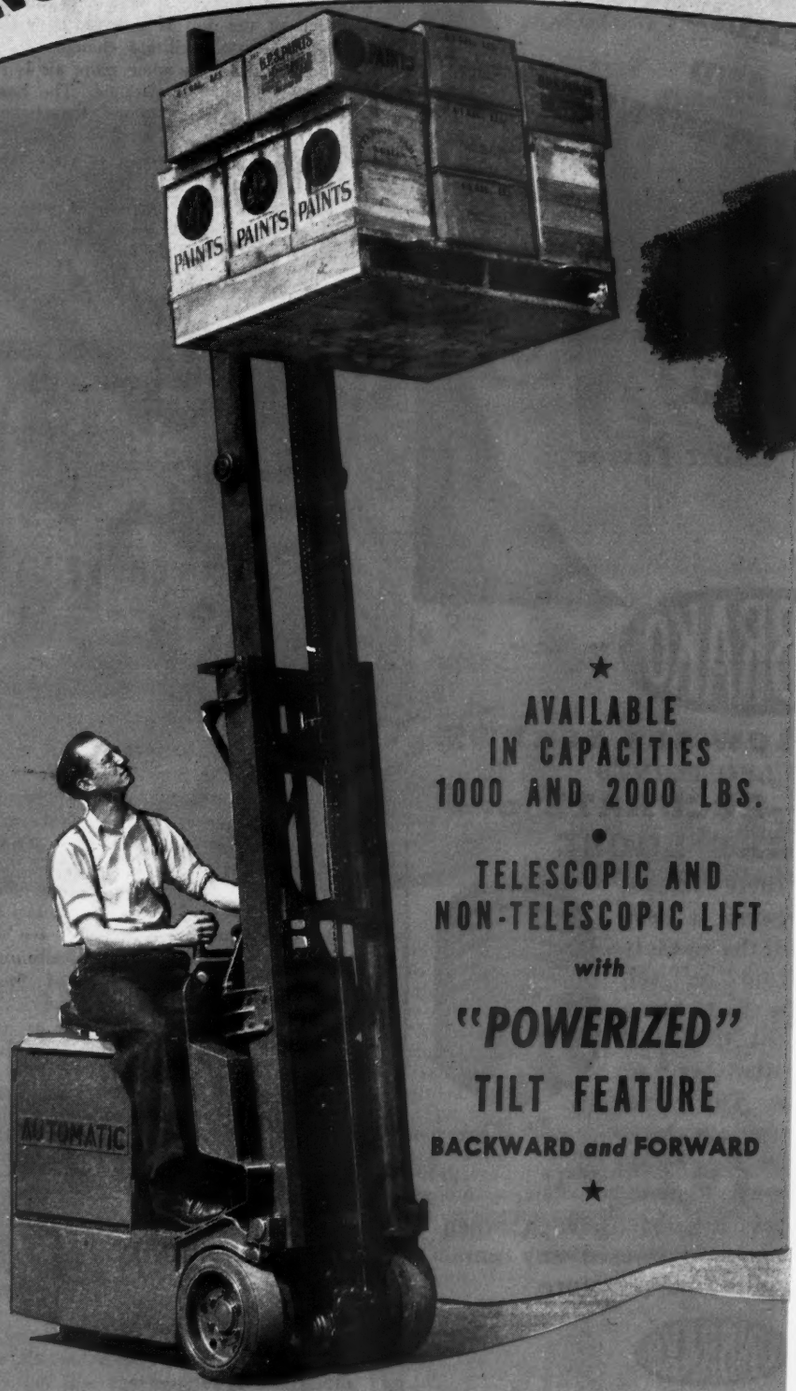
Variable-Speed Drives

Variable-speed drives, with capacities up to 80,000 lb. torque and speed ranges from 310 r.p.m. forward to 9 r.p.m. reverse (standard 1-10 hp. motor), are available for either right- or left-hand installation, vertical or horizontal output shafts. In the larger capacities of the 2 basic units, the output shaft is vertical—upward or downward, short or extended, the latter employing an outboard bearing. Standardized reduction drives to increase load capacity of units are available as accessories. Drain plugs, fill plugs, and oil-level inspection plugs are located outside of the gear case. Remote control by mechanical or electrical means, and a control for synchronizing speeds of 2 or more units are available. Designed to be changeable to work other than that for which it was originally intended, e.g., left-hand unit can be converted into a right-hand unit by inverting the unit. The basic unit measures 1x2½x3 feet. Mechanical Handling Systems, Inc., 4700 Nancy Ave., Detroit.

Propeller-Type Fans

"L" Breezo propeller-type fans, for application where it is desirable to have the motor outside a closed system or outside the air stream—in exhausting from paint spray booths, in chemical plants where there is

ANOTHER TRADE AUTOMATIC MARK LEADER



THE *New* Lightweight "CHAMPION" CENTER-CONTROL FORK TRUCK

★

AVAILABLE IN CAPACITIES 1000 AND 2000 LBS.

●

TELESCOPIC AND NON-TELESCOPIC LIFT

with

"POWERIZED"

TILT FEATURE

BACKWARD *and* FORWARD

★

Custom-Built by "Popular Demand" of Industries Large and Small, for a Convenient "Electric Propelled" Lightweight Fork Lift-Truck to pick up, transport and stack 1000 and 2000 lb. capacity loads — Efficiently — Economically — Systematically —Safely—in minimum operating space and operate on 4000 lb. capacity elevators.

This New Lightweight "CHAMPION" FORK TRUCK can decrease handling costs in your Shipping and Receiving departments for loading and unloading box cars, motor trucks and trailers. In your production and stores department materials handling can be profitably co-ordinated in transporting and stacking light loads quickly—conveniently—safely in minimum aisles.

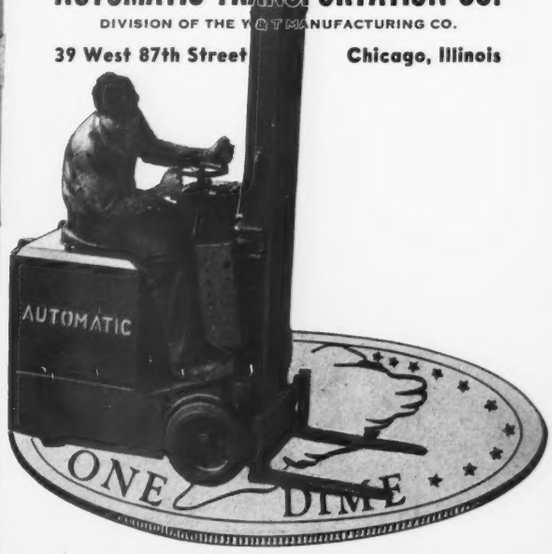
"AUTOMATICS" New Lightweight "CHAMPION" is compactly and sturdily built. . . . Has convenient, simplified, Center-Control for clear operating vision and maximum efficiency. Is powered by dual-motor front drive ***no***-differential ***no*** drive shafts. Can be maneuvered quickly in congested areas through two wheel castor-type controlled steer. Truck literally "turns on a dime." Is built with telescopic and non-telescopic fork lifts. Maximum lift range attained with minimum overall height. Has powerized tilt-feature backward and forward.

Get the full facts at once, with complete details and prices about this New "AUTOMATIC" Lightweight "CHAMPION" Fork Truck.

AUTOMATIC TRANSPORTATION CO.

DIVISION OF THE Y & T MANUFACTURING CO.

39 West 87th Street **Chicago, Illinois**



Truck Literally Turns on a Dime

ON PALLETS" . . *Save* **TIME** . . *Aid* **LABOR** . . **CUT COSTS WITH** ***New*** **"AUTOMATICS"**

YOU CAN
PREVENT MACHINERY
BREAKDOWNS AND
CUT YOUR MAINTENANCE
COSTS BY USING

The Set Screws
with
"The Third Factor"

UNBRAKO

SELF-LOCKING HOLLOW SET SCREWS
WITH THE KNURLED POINTS
are 1—STRONG 2—ACCURATE and
3—WON'T SHAKE LOOSE

Fig. 1645
Pat's. Pend'g.

When you use these screws, you're insuring against a heap of trouble. Gone is the need to continually check-up on set-screws . . . you just know they're tight all the time, and as they do stay that way no trouble can follow. The clever knurling on the points locks them in place, once they're set up in the usual way. Removal is easily made with the ordinary hex bar wrench when adjustments are needed and the screws re-used any number of times. Write now for samples and literature.

Fig. 1641
Pat's. Pend'g.

Fig. 1646
Pat's. Pend'g.

UNBRAKO

SELF-LOCKING
SQUARE HEAD SET SCREWS

These, too, are supplied with the knurled points that give them the added safety factor. In use they stay put, but can be removed without trouble and used over again any number of times. Ask us more about them.

STANDARD PRESSED STEEL CO.

BRANCHES BOSTON DETROIT INDIANAPOLIS
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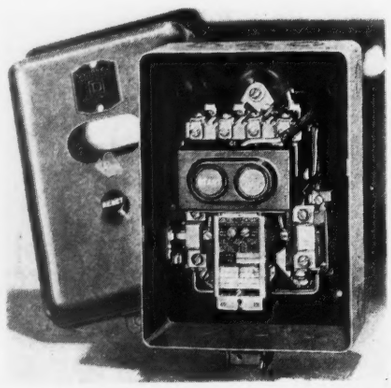
BRANCHES CHICAGO ST. LOUIS SAN FRANCISCO

an excess of moisture, heat, dust, or corrosive fumes—are designed so that the air inlet may be at top, bottom, or either side, and may be changed from one to another location on the job if necessary. V-belt drive is used to facilitate change of fan speed and motor size when more air is required against high resistance. The bearing at end of shaft in air chamber is bronze, inclosed, and wool packed. Inclosed ball bearings packed in grease can be furnished. Available in 7 sizes from 12-36 in. with rated capacity at free delivery of 1,080-10,800 cu.ft. per minute. Buffalo Forge Co., Buffalo, N. Y.



Starters

Size 0, Type R, Class 8536 automatic starters, supplementing the present line of vertically operating automatic starters, have maximum polyphase ratings of 2 hp., 220, 440, 550 volts; maximum single-phase ratings of 1 hp., 110 volts and 1½ hp., 220 volts. Some of its features are double-break silver contacts, vertically operating magnet, thermal overload relays. The starters are available with dust-tight and water-tight inclosures, and as combination starters with either disconnect switches or circuit breakers, and in the reversing type. Square D Co., Detroit.

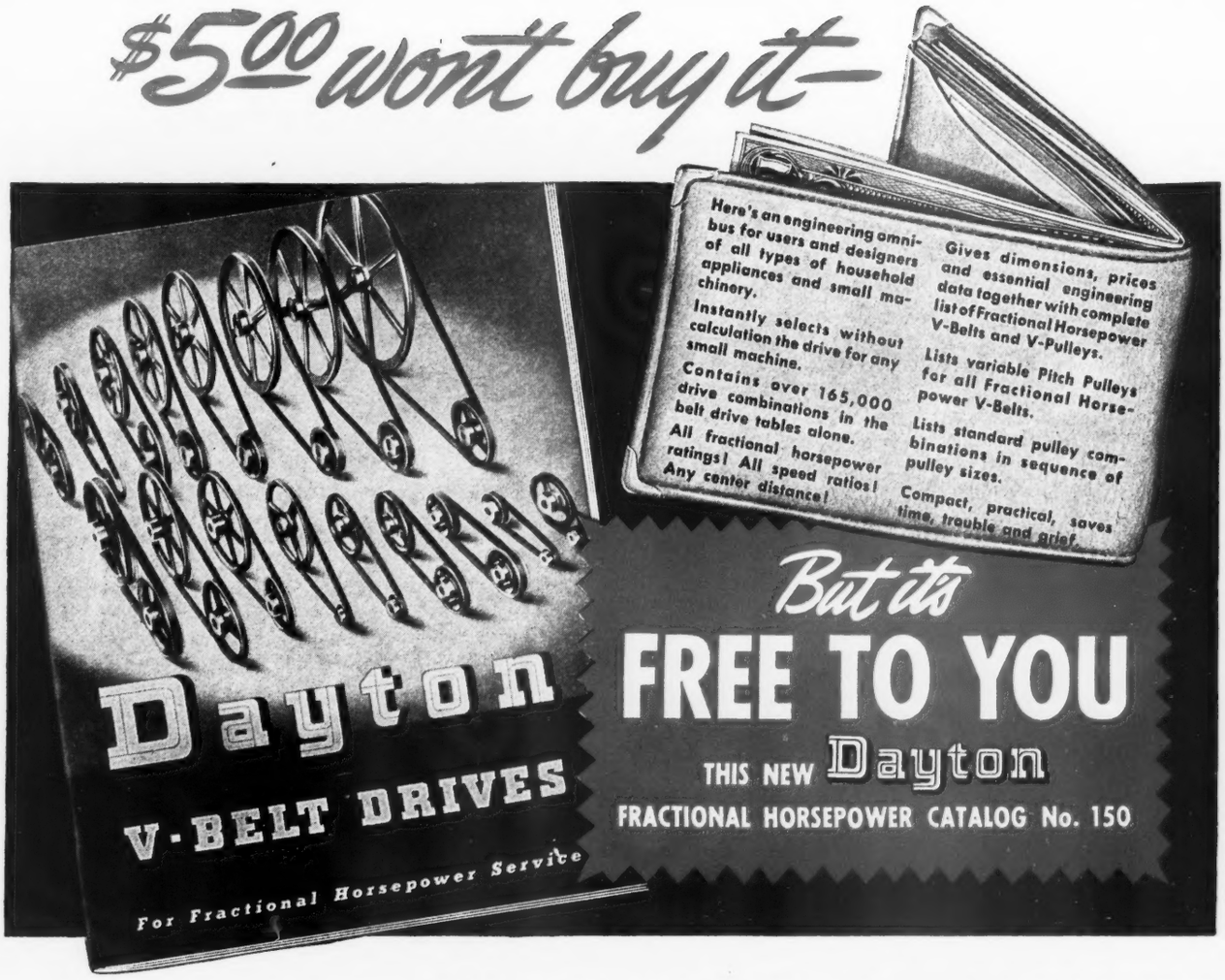
Flooring

"Theco" wood fiber flooring consists of fibrous particles and special cements. It comes prepared in a dry form. With water added it is ready for application at a thickness of $\frac{3}{8}$ to $\frac{5}{8}$ of an inch. It is said to bond to any surface—wood, steel, or concrete—and to produce a smooth, non-slip, resilient surface that will not chip, crack, or dust, nor indent under standing loads or heavy trucking. It is claimed to be fire-, spark-, water-, and oilproof. The Hancock Engineering Co., 3006-08 Chestnut St., Philadelphia.

Correction

The cut that appeared on page 116 of the September issue, under the item describing the Bonney Forge & Tool Works' socket set, should have appeared on page 96 with the description of Square D Company's double-throw switches.

$5.00 won't buy it—


Here's an engineering omnibus for users and designers of all types of household appliances and small machinery.
Instantly selects without calculation the drive for any small machine.
Contains over 165,000 drive combinations in the belt drive tables alone.
All fractional horsepower ratings! All speed ratios! Any center distance!
Gives dimensions, prices and essential engineering data together with complete list of Fractional Horsepower V-Belts and V-Pulleys.
Lists variable Pitch Pulleys for all Fractional Horsepower V-Belts.
Lists standard pulley combinations in sequence of pulley sizes.
Compact, practical, saves time, trouble and grief.
Dayton
V-BELT DRIVES
For Fractional Horsepower Service
But it's
FREE TO YOU
THIS NEW Dayton
FRACTIONAL HORSEPOWER CATALOG No. 150

Perhaps you know that Dayton Standard Fractional Horsepower V-Belt Drives simplify design, reduce costs and assure maximum service. You may be familiar with the patented construction of Dayton V-Belts which give greater strength and endurance. If so, you know that Dayton V-Belts do not squash, twist, vibrate or stretch. They work on extremely short centers. They have extreme crosswise rigidity.

Yet you couldn't possibly have at your finger tips all of the information that's crammed into the engineering omnibus which is Dayton's new Catalog No. 150. In one of its sections over 165,000 drive combinations are shown in the belt drive tables alone. A few of the highlights of No. 150's contents are shown on this page. But only a study of the catalog, itself, will reveal the priceless information it contains.

For instance, the reference tables in sequence of pulley sizes are of tremendous help to the machinery designer in laying out drives for a range of machines to be made on a production basis. Or, if you are developing a machine to be made in *quantities,* yet one which will be operated at different speeds and capacities, the reference tables automatically give the required information.

Dayton Fractional Horsepower V-Belts are made in *three* standard sections in a complete range of lengths to meet all conditions of small machinery service. They are being used on everything from oil burners to office appliances . . . from stokers to shoe machinery . . . from compressors to coffee mill machinery . . . for household pumps, display fixtures, laundry, textile, tanning machinery and for hundreds of other uses. So, whether you make or use small machinery or household appliances, remember that $5.00 will not buy the Dayton Catalog No. 150, but it is yours *free.*

Write for it today!

Dayton

V-BELT DRIVES WITH DAYTEX CORD

MADE BY THE WORLD'S LARGEST (D) MANUFACTURER OF V-BELTS

GIVE THIS TO YOUR SECRETARY—

Write today for Catalog #150 (the Engineering Omnibus) just issued by

THE DAYTON RUBBER MFG. CO.
DAYTON, OHIO

Whether for fractional or a thousand horsepower there is a Dayton V-Belt Drive for the job.

position to see that the company is receiving value for expenditures made and he should be given a clear understanding of the importance of this part of his job. By having the department heads help in working out the final plans in an atmosphere of friendly cooperation they take an added interest in the study of costs and their budget automatically becomes a part of their own personal ambition. Only in this way can the full confidence of the factory organization be gained, and the full meaning of the budget be understood.

Costs in Production—In going over the preliminary budget with the department head in preparation for the final budget, all available past history and future estimates for cost elements should be on hand for guidance in setting the final cost budgets. This information can be conveniently accumulated in permanent form on a Budget Data Sheet (Figure 5) which shows all pertinent cost information for each account and department. The actual labor and material usage, the labor rate, hourly earnings, material price history and cost standards, prospective reductions that can be effected, and any other information of this type should be reviewed in detail to insure fairness and accuracy of the estimates.

Wherever possible the detailed cost elements should be inspected in as many different ways as possible in order to assure accounting accuracy in the final estimates. For example, estimated direct material expenditures can be checked by analyzing the type of material used against the direct material costs reported in the past for each product in the line. A thorough crosschecking of the individual accounts and cost elements is well worth the time and expense which such an operation will involve.

Holding Costs in Line—After the foremen's recommendations and estimates are incorporated in the preliminary budgets, the estimated expenditures for each cost element can be analyzed to determine how each will vary at different levels of production and the findings can be permanently recorded on the Budget Data Sheet (Figure 5). The costs so recorded are then used to compile the Cost-Volume Schedules (Figure 4) which present the estimated expenditures per operating day at each level of activity for the department. These schedules in turn are used to compute the final departmental budgets for the coming year. This is done by multiplying the allowance per operating day at each budgeted level of output by the number of operating days in each month.

Budgeted expenditures of staff departments for services furnished and chargeable to the factory production department can be allocated on the basis of the value of service rendered to each production department. This brings the expenditures of the employment, industrial engineering, planning, and other staff departments into the manufacturing cost budget. Space rental and depreciation are also budgeted in connection with the capital expenditure budget which is made to cover all fixed assets.

Where changes in the type of product manufactured are expected to occur during the course of the year, the Cost-Volume Schedule must be constructed to allow for the change in the average mix that will prevail during the different periods in the year. Usually this can be limited to quarterly or semi-annual changes. The annual budgets during the period, therefore, will not be thrown out of line because of such variations.

When the budgets are completed a

For *Split-Second* Assembly Work

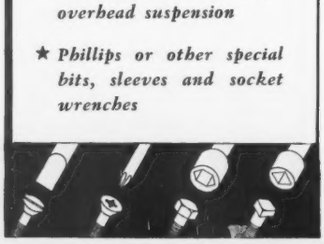
★ *All speeds — all kinds — one just right for a saving on your work*

★ *Adjustable tension clutch*

★ *Automatic grip and trigger switch models*

★ *Economo-Switch model for overhead suspension*

★ *Phillips or other special bits, sleeves and socket wrenches*



STANLEY ELECTRIC SCREW DRIVERS

• Illustrated above is the Stanley Screw Driver No. 31, with Adjustable Tension Clutch. Automatic Grip and Trigger Switch; for hand operation or stand use with lever or foot-treadle control. It will drive slotted screws up to No. 12—2″ or Phillips Recessed Head Screws up to No. 16 in hardwood; and handles nuts up to 5/16″ bolt size.

• Stanley makes a *complete* line of electric screw drivers to transform time-wasting assembly operations into split-second routine. Special Stanley Bits, Sleeves and Socket Wrenches are available to fit the job. You'll find full information in the Stanley Electric Screw Driver "Fact Folder." Write for your copy today. Stanley Electric Tool Division, The Stanley Works, New Britain, Conn.

STANLEY ELECTRIC TOOLS "COST LESS PER YEAR"

Greater Stability

of Gulf quality oils

SHOWS UP in long-time service!

Slight differences in oil quality become magnified in service, having profound effect on wear of moving parts and ultimate maintenance expense!

TWO lubricants may be manufactured to look alike, and to meet the same specifications—but that's no guarantee they will perform alike! One may retain its lubricating qualities under severe temperature and load conditions, while the other may depreciate and allow friction to take a heavy toll in wear and maintenance expense.

These variables in characteristics of lubricants are being studied each day in the Gulf laboratories by a large staff of qualified technologists. Through this exhaustive research, Gulf has developed lubricants with performance qualities which can not be predicted from the usual inspection tests.

You can tell the difference when you use them! Their greater stability shows up in long-time service. Under severe operating conditions they prove their endurance and resistance to decomposition. These better oils help operating men step up production schedules, cut down costs of machine operation. Plant managers report greater productivity from their equipment after it has been checked over by an experienced Gulf lubrication engineer and his recommendations adopted for the proper application of improved lubricants.

To evaluate the importance of certain differences between lubricants, Gulf research technologists do experimental work with this sleeve bearing which has been made with a tolerance of less than 1/10,000 of an inch, and might be considered a perfect bearing. Faults in its construction have been eliminated in order that results may not be confused by secondary effects of such faults.

Every public utility, railroad, industrial and marine operator from Maine to Texas can have the benefit of this cost-reducing lubrication service. More than 1100 Gulf warehouses in 30 states make these higher quality oils and greases quickly available to you. Write or phone your nearest distributing point today . . . Gulf Oil Corporation—Gulf Refining Company, Gulf Building, Pittsburgh, Pa.

Maintenance Costs REFLECT Oil Quality

Big transit company executive says: "Sure, changing to Gulf's higher quality lubricants has increased our oil bill $20,000 this year. But with better lubrication we have cut maintenance cost $200,000! Furthermore, we're giving our customers better service."

Small Diesel plant superintendent says: "We've reduced maintenance costs 66⅔% since we adopted Gulf's higher quality Diesel lubricants. Now we are able to run through a whole summer season without any of the operating troubles we previously experienced."

GULF INDUSTRIAL LUBRICATION

A COMPLETE LINE OF MORE THAN 400 OILS AND GREASES FOR INDUSTRY

final conference is held with the superintendents during which a check-up of over-all expenditures will give an indication as to where adjustments in the preliminary budget figures must be made. Two courses of adjustment are open when an increase for one particular department over the preliminary estimate seems necessary. Since the original preliminary budget was set to check out with the estimated profit and loss sheet, an increase in the allowable expense in one department must be met with an offsetting reduction in some other department; otherwise the extra expenditure will inevitably result in a reduction in the projected profit.

This point of view is one of the most forceful arguments that can be used to induce the department heads to keep their costs at a minimum. At the same time this completely coordinated budget system offers a method of knowing in advance where weaknesses and danger points in the organization exist, so that the uneconomic conditions underlying the situation can be corrected before they can jeopardize the attainment of the established goal.

[A third article in this timely series is scheduled for December—ED.]

Vestibule Schools

(Continued from page 58)

was given to quality of plant lighting.

In the department were placed samples of the machines on which training was thought necessary. Benches and fixtures were also set up for teaching assembly and inspection jobs.

Women teachers were selected. The company considered this important. When a new girl employee came in ready to begin this strange (to her) factory work, the first things she saw were these women teachers running machines. Invariably the girl figured that if these women could do the work, why so could she.

The employment department was meanwhile doing a good job of selection, keeping in mind that some women were well qualified physically to operate heavy-duty machines, whereas others could obviously be expected to handle only light work on the lighter machines. If a girl had relatives in the plant, she was placed as far away from them as possible.

The system of teaching was carefully standardized. A teacher handled from 3 to 5 girls at a time. First she explained the character of the metal in the part, then the tools and their use, going over with each girl the work that each tool was supposed to do.

During this initial stage the teacher operated the machine. Then the new girls were allowed to try. Whenever they made a mistake, they were corrected in a friendly manner.

Note here that *these new girls were trained to do just one job.* No attempt was made to give them even the rudiments of a mechanical education. *The sole object of the training was to make a girl skilled on a single operation in the briefest possible time.*

Length of time naturally varied with the operator and the class of work. It ranged from 3 to not more than 10 days. In less than 10 days' time the training department was turning out girls who could operate hand turret lathes on work requiring great precision. It was found that the girls, on entering the shop after this quick training, attacked their jobs with vigor and confidence, and usually were able inside of three weeks to reach a high average of production and thus earn bonuses.

Of course it was necessary to continue in the shop the training begun in the school. Operatives were therefore divided into small groups, each with a carefully selected job boss. The number in each group varied from 7 on the more difficult jobs to as many as 30. It was the job boss's duty to set up the ma-

● Ever since "Daddy" came home from work with a smashed foot, the whole family has been grouchy. "Daddy" just sits around and broods. Mother cries and complains, because she can't make ends meet with only compensation money.

As every factory executive knows, these are the things which destroy labor harmony ... that cut down efficiency and cause discontent. That's why it's so important that SAFETY be a *must* on every labor relations program.

Hy-Test Safety Shoes can play a big part in increasing safety in your plant. First... because these shoes, with the anchored, steel toe cap, prevent foot and toe injuries and save materially on your compensation and hospitalization costs. Second ... because men wearing safety shoes are more safety-conscious in regard to all working hazards.

Workers like to wear Hy-Tests. That's why they are America's largest-selling safety shoes. It will pay you to find out about them. Write for booklet today.

A Hy-Test Shoe for Every Job . . . Hi-cuts, Shoes, and Oxfords . . . Dress, Semi-dress, and heavy-duty Styles

TURRET-TOP TOE PROTECTION

Every Hy-Test Safety Shoe has this steel toe cap with the patented anchor flange. It has saved hundreds of toes and thousands of compensation dollars.

HY-TEST SAFETY SHOES

Designed and Manufactured Exclusively by Hy-Test Division, The International Shoe Co., St. Louis, Mo., The Nation's Largest Shoe Manufacturer

The Man Who Cuts the Metal

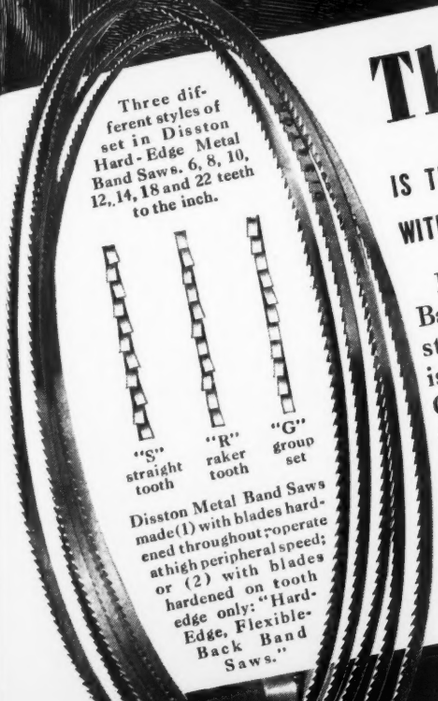
IS THE MAN TO PROVE YOUR PROFIT WITH FLEXIBLE-BACK DISSTON BANDS

It's in actual cutting that Disston Bands prove their accuracy and stamina. For in metal cutting, there is no substitute for Disston Steel! Carefully processed, it's a steel for tough, flexible, durable cutting on modern alloys, hard materials; under new and harder conditions.

Disston Hard-Edge, Flexible-Back Bands stay sharp . . . every tooth is alike; edge hardened. All teeth are *milled*, scientifically and accurately set. And Disston Bands are unequalled in taking the bend over a wheel, in resisting the strain of quarter turning.

Let the man who cuts the metal prove the superiority of Disston Bands on the widest range of materials, sizes and shapes ever cut on a band saw machine. Henry Disston & Sons, Inc., Phila., U.S.A.

ASK THE DISTRIBUTOR WHO SUPPLIES YOU WITH DISSTON PRODUCTS FOR DATA



Three different styles of set in Disston Hard-Edge Metal Band Saws. 6, 8, 10, 12, 14, 18 and 22 teeth to the inch.

"S" straight tooth

"R" raker tooth

"G" group set

Disston Metal Band Saws made (1) with blades hardened throughout to operate at high peripheral speed; or (2) with blades hardened on tooth edge only: "Hard-Edge, Flexible-Back Band Saws."

DISSTON METAL-CUTTING BAND SAWS

chines, keep them in excellent running condition, and see that defective work was kept at a minimum. He was responsible both for quality and quantity of work delivered by his group. Incidentally, his own bonus depended upon the average bonus of all the girls in his group. Thus it was to his interest to help the newer and poorer operatives rather than concentrate on the good ones.

As an example of what inexperienced women were able to do on difficult operations, the company was producing base forgings of aluminum on hand turret screw machines. There were 56 gaging points on this forging, with limits ranging from 0.0005 to 0.0002 inch.

In January, 1916, the average production of 31 women employees was 8 pieces per hour. These women were put into the training department and given specialized instruction along with new girls being hired for the job. Four weeks later, average producton was raised to 25 pieces an hour, and, at the time the aritcle was written, was 55 pieces.

This company had a large assembly department employing over 2,000 girls. Two years previously, two sets of engineers reported that the best output possible from this assembly division was 15,000 complete fuses per day in two shifts. But by training the girls, first in the vestibule school and later in the shop, the company was able to reach an average production of 38,000 fuses per day in one shift.

In addition to fuse work, the company was building optical instruments. Much of this work had to be held within tolerances as low as 0.00025 inch. Believe it or not, the training school was able to turn out a high-grade body of lens grinders, both men and women, in something like 6 weeks' time.

Equally successful was the vestibule school conducted at Packard Motor Car Company and described in *Industrial Management* for November, 1918, by D. G. Stanbrough, general superintendent for that company.

Packard's training course was based on the experience that all employees, whether on assembly work, on a machine, on inspection or welding or core making, use measurements at every turn. As a starting point in its instruction, therefore, the company supplied the student with a blueprint and a set of pins, the idea being to measure the pins and set down the results on the blueprint in the proper places. Time allotted for this work was 18 hours. Measurements covered use of scales, calipers, pitch gages, micrometers, bevel protractors, and final test pieces involving the use of all tools.

Time, 7 to 16 Days

From this point the beginner was given instruction on any one of a wide variety of machines, including lathes, milling machines, gear cutters, and broaching machines, also on inspection, assembly, testing, welding, soldering, stockroom work, and many other jobs.

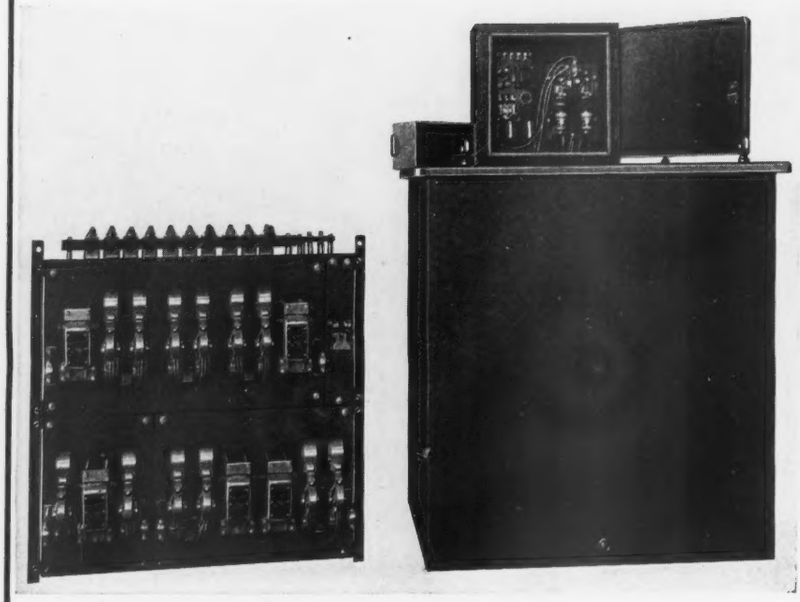
Time required to complete this special training ranged from 7 days for a clerk to 16 days for a welder, 10 days being average time on machine tools.

Packard used men who were good mechanics to train women to act as assistants. The number of assistants varied from 1 on grinding to 3 on lathe work and welding, and 4 on assembly work. The number of students under each assistant ran from 2 on grinding to as many as 6 on finished inspection. (An advance course was run for instructors, who were given shop mathematics and mechanical training similar to that given apprentices.) The cost of operating the Packard school was $52 per student, and the school's output in a typical month was 332 employees.

Packard attributed its success to good instructors, good tools, and clean, light, well-ventilated workrooms. The company found, in dealing with large numbers of employees who have little or no conception of the job in hand, a strong

EC&M STARTER for

LONG-TIME STARTING OF SCAVENGER BLOWER DRIVE



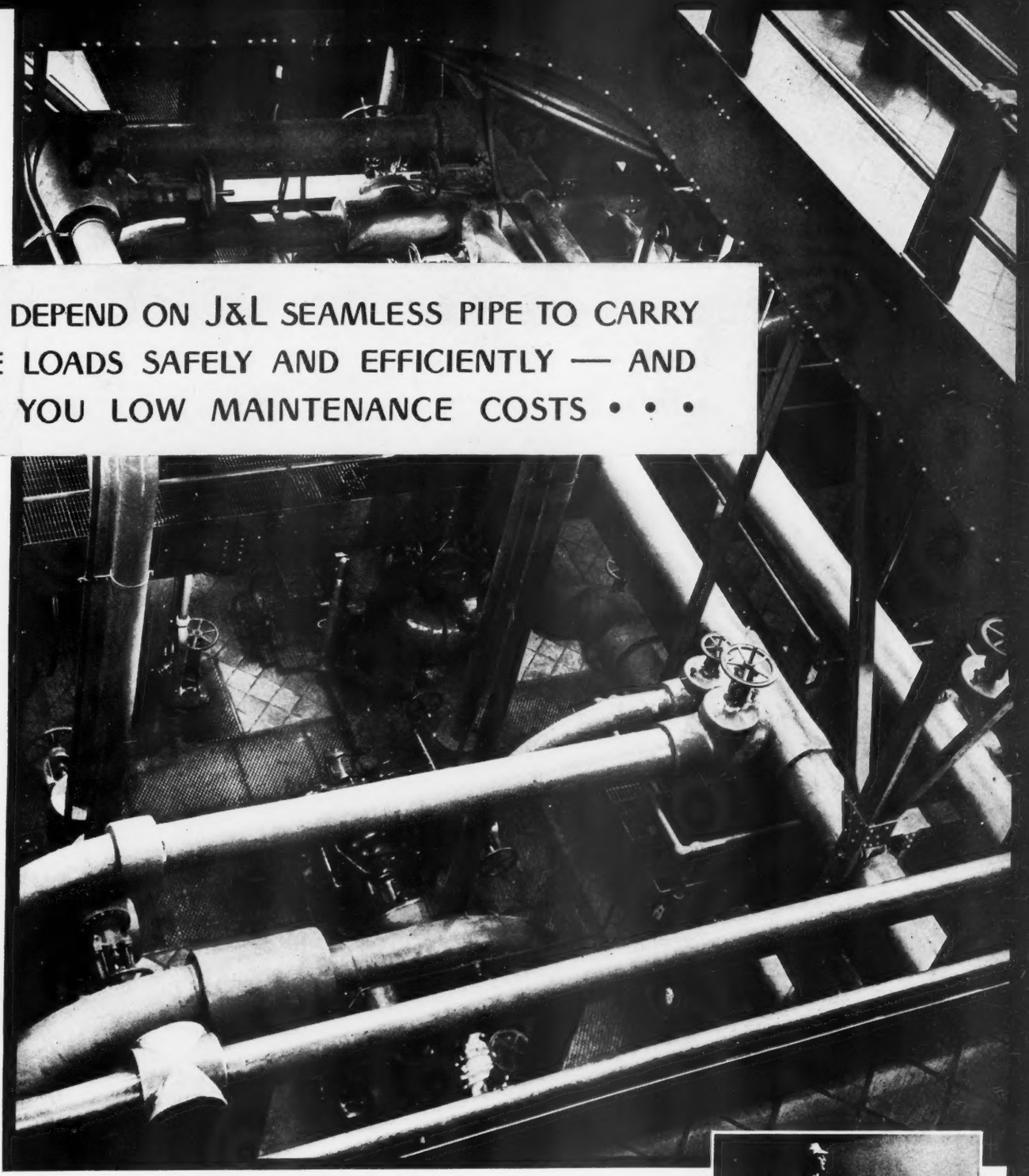
THIS illustration shows an EC&M Oil-immersed, Auto-transformer Starter for reduced voltage starting of a 350, 440 Volt motor driving a scavenger blower in a municipal diesel plant. Starting current is kept low by providing a heavy duty starter capable of long-time acceleration on the auto-transformers. Transition from reduced voltage to full line voltage is by EC&M NEO-TIME Control which is conveniently located in overload relay compartment. View at right shows enclosing cover for NEO-TIME panel setting on oil-tank cover.

View at left above shows EC&M Type LZ Magnetic Contactors for handling the main motor circuit. They are mounted in the oil-tank with auto-transformers and are completely oil-immersed. During transition, the circuit to the motor is not broken; instead, continuous torque is applied to the motor from the instant of starting.

EC&M Booklet No. 88 illustrates this attractive unit as well as many other custom built motor controls. Write today for your copy.

THE ELECTRIC CONTROLLER & MFG. CO. E&M CLEVELAND, OHIO

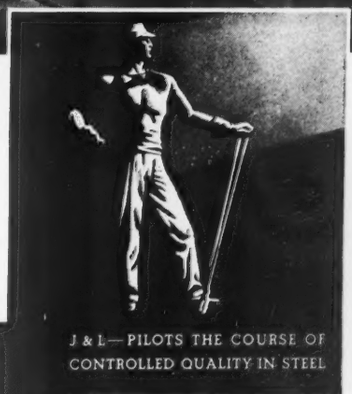
HEAVY DUTY MOTOR CONTROL FOR CRANES, MILL DRIVES AND MACHINERY • BRAKES • LIMIT STOPS • LIFTING MAGNETS AND AUTOMATIC WELD TIMERS.



YOU CAN DEPEND ON J&L SEAMLESS PIPE TO CARRY PRESSURE LOADS SAFELY AND EFFICIENTLY — AND TO GIVE YOU LOW MAINTENANCE COSTS • • •

By specifying J&L Seamless for power piping, engineers and maintenance men throughout the country have endorsed it for strength, safety and dependability. Every length of J&L Seamless is rolled from a solid billet of "controlled quality" steel. There are no welds, therefore no chance of failure at or near a weld.

Scientific control of all J&L finishing operations assures uniform wall thickness, concentricity and the right ductility for easy bending and upsetting. Therefore when J&L Seamless is specified, the manufacture of joints and the installation of the pipe move along smoothly and efficiently. In hundreds of plants J&L piping is giving completely satisfactory service. Specify J&L Seamless for your power piping jobs. In the meantime, get helpful information on piping applications by writing for our Handbook SP-4.



J & L—PILOTS THE COURSE OF CONTROLLED QUALITY IN STEEL

JONES & LAUGHLIN STEEL CORPORATION

AMERICAN IRON AND STEEL WORKS
PITTSBURGH, PENNSYLVANIA

J&L STEEL

J & L—PARTNER IN PROGRESS TO AMERICAN INDUSTRY

tendency toward lack of direction in the efforts of the students—that strict discipline was therefore vital to success. Every student, it soon discovered, needed practically individual attention. On elementary work an instructor could take care of 5 students, but on machine work 1 to 3 was the outside ratio, and 1 to 2 gave best results.

Further evidence that the vestibule school filled a very real need during the World War is supplied by an article in *Industrial Management* for March, 1919, by James W. Russell who had helped organize a training department at the Curtiss Aeroplane & Motor Corporation's factories at Buffalo, N. Y.

Curtiss, like many another concern, had been compelled to hire "almost anyone who could fit in somehow." The management finally resolved that it would fit women to the needs of some of its divisions. Hence its vestibule school, which like other schools of that era was set up apart from the regular production divisions, although segregated space in some of the production departments was used for training when it appeared impracticable to move the job or the material to the school proper.

Mr. Russell found that the best women operators were between the ages of 25 and 40. The Curtiss school is said to have passed unskilled men and women through it at the rate of 30 a day. A government inspector stated at the time that after 4 days' training previously unskilled girls were doing the best cable splicing he had ever seen; their average output as compared with the old operators' was in the ratio of 55 to 40. On another operation the time required was 48 minutes as against 60 minutes.

Another concern using ordinary methods of recruiting labor found in 1917 that it had a turnover of 10,000 in a force of 15,000. The cost of securing each new worker was estimated at not less than $50. It then proceeded to train—to "upgrade" 1,000 men from simpler jobs. And to fill the places thus made vacant it recruited women, who were quickly trained in a vestibule school at relatively low cost.

No isolated cases were the above. The Lincoln Motors Company of Detroit, sometime in 1918, took on 300 women, sending them through a vestibule school before even they saw the inside of the factory.

Here the training was all done in a room 18 by 40 feet. During an extra rush period some of the new women workers could be kept in the training room only one day. It was not long enough to teach them much, but it was found that it removed their fear of the shop and so enabled them to learn more quickly out on the job.

Began with Four Machines

Peter F. O'Shea, in an article in *Industrial Management* for September, 1919, described a shop training school for women which was then in full operation at Greenfield Tap & Die Corporation, Greenfield, Mass. It began, however, as a vestibule school with only four machines.

Its original purpose was to "take in girls who had never done factory work and make them valuable workers in a fraction of the time that would otherwise be necessary."

This company paid the girls a permanent day rate from the start. Most girls were actually earning their wages by the end of the second day.

Some of the girls needed two weeks, others only one week, in the school. They were taught four simple operations on a lathe—rough turning, finish turning, and so on—before being put to work in the shop.

In this way the new girl knew when she was introduced to a machine that it wouldn't bite. She learned that its motions were definite and simple, that it responded to every motion of the "handles," and that the dimensions of

(Continued on page 132)

HOW YOU SAVE MONEY
WHEN YOU USE
SMOOTHARC
Welding Electrodes
IN THIS NEW
Air-Tight Container
Think what it means to have electrodes that are kept "factory fresh" in moisture-proof containers . . . laboratory performance on the job regardless of location or atmospheric conditions — whether you use them next week or next year.
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The P&H air-sealed container, eliminates the usual expense of maintaining a dry house; protects you against losses due to spoilage; assures higher percentage of metal deposits by reducing spatter loss; enables you to buy in quantities, at quantity prices. Ask us to send you Bulletin R-5 on Smootharc Welding Electrodes. Ask also for Smootharc's series of "Helpful Welding Hints" on production and maintenance work. Address the Harnischfeger Corporation, 4525 West National Avenue, Milwaukee, Wisconsin.
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WELDING ELECTRODES • MOTORS • HOISTS
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A neighbor's trouble sold them on KOPPERS WATERPROOFING

THE ARCHITECTS had a plan for waterproofing the foundations of the new building, but Mr. Thompson was against the idea. That finished that.

A FEW DAYS LATER, a great hubbub started around the building across the street. Crews of workmen were ripping up concrete, shoveling out earth and exposing the foundations on all sides of the building. This went on for days.

Obviously, a big and expensive job.

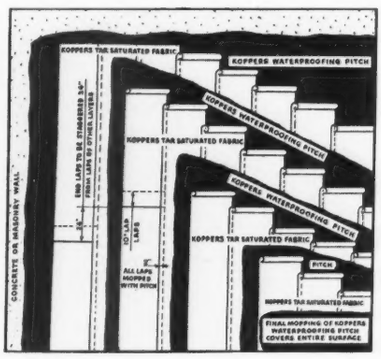
"WHAT'S GOING ON over there?" Mr. Thompson asked.

"The foundations were leaking," said his assistant. "They had to dig up the ground and apply waterproofing."

"Waterproofing?" said Mr. Thompson, grabbing his hat. "I'm going over."

THE HEAD of the company across the street told Mr. Thompson the whole sad story. Water getting through the foundations. Damaging machinery. All sorts of remedies tried, but finally the decision that nothing but Koppers Tar Membrane Waterproofing on the water side of the foundations would do.

BACK IN his office, Mr. Thompson sent for the architect again. "I've changed my mind," he said, "Maybe we had better do something about waterproofing that new building of ours."


KOPPERS TAR SATURATED FABRIC
KOPPERS WATERPROOFING PITCH
KOPPERS WATERPROOFING PITCH
KOPPERS TAR SATURATED FABRIC
KOPPERS WATERPROOFING PITCH
KOPPERS TAR SATURATED FABRIC
PITCH
KOPPERS TAR SATURATED FABRIC
FINAL MOPPING OF KOPPERS WATERPROOFING PITCH COVERS ENTIRE SURFACE
CONCRETE OR MASONRY WALL
2ND LAPS TO BE STAGGERED 36" FROM LAPS OF OTHER LAYERS
10" LAP
LAPS
ALL LAPS MOPPED WITH PITCH

THE FOUNDATIONS of the building are tightly encased in a strong, elastic, continuous blanket of Koppers Tar Waterproofing Pitch and Tar-Saturated Fabric.

THE FOUNDATION is dry. The machinery is completely protected against water. The concrete is safe from elements in the soil which might cause it to deteriorate. Koppers Tar Membrane Waterproofing, being properly applied, also makes the building termite-proof.

ROOFING—The ability of Koppers Coal Tar Pitch to resist prolonged contact with water (which makes it so valuable for waterproofing) also makes Koppers Coal Tar Roofing Pitch so trouble-free and long-lived. Specify Koppers Coal Tar Pitch and Felt for your roofs.

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Roofing . . . Bituminous-base Paints . . . Tarmac Road Tars . . . Pressure-treated Timber Products . . . American Hammered Piston Rings . . . Bronze Iron Cylinder Packing . . . Coal . . . Coke . . . Fast's Self-aligning Couplings . . Koppers D-H-S Bronze . . Engineering and Construction Work . . Material-handling Equipment

KOPPERS COMPANY · PITTSBURGH

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Top-Quality JENKINS iron VALVES

Jenkins-equipped Engine Room where intelligent planning assures light and power every minute of every day.

In serving humanity, Cornell Medical Center enlists the aid of 24,730 Jenkins Valves. An independent* study shows annual maintenance has been less than one half of one percent of initial Valve cost.

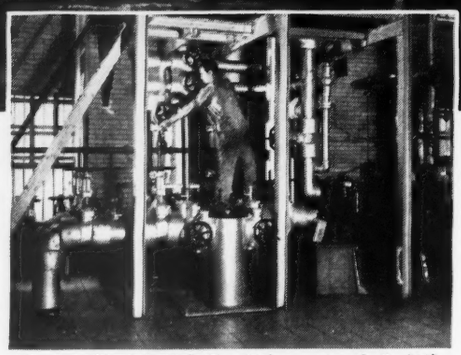
A WORKING DAY at New York Hospital-Cornell Medical College means—"all day, every day". And behind the scenes, from their giant power plant to the smallest sink or sterilizer, are thousands of Jenkins Valves—in a catacomb of piping and auxiliary equipment that assures power and steam and water whatever the emergency.

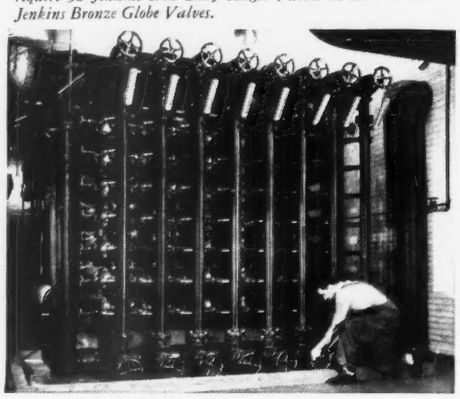
Since the project was built 8 years ago, Mr. W. W. Downey, Director of Engineering and Maintenance has kept accurate records of operating costs—finds that "annual maintenance on our 24,730 Jenkins Valves costs us less than one day's fuel bill".

When you judge Iron Valves by—*total cost per year of valve life*—you will find Jenkins "Iron" *at standard prices* is your best buy.

JENKINS BROS., 80 White St., New York, N.Y.; Bridgeport, Conn.; Boston, Mass.; Atlanta, Ga.; Philadelphia, Pa.; Chicago, Ill.; Houston, Texas; Montreal, Canada; London, Eng.

* *Anderson, Nichols, Associates, Consulting Engineers*





Above: Jenkins Iron Body Gate Valves serving the Fuel Oil Heaters. Below: This bank of Refrigerant Condenser Coils require 32 Jenkins Iron Body Angle Valves as well as 112 Jenkins Bronze Globe Valves.

DIAMOND ANNIVERSARY 1864 — 1939

NEW!

DULUX HIGH-HIDING MILL WHITE AMAZES PLANT OPERATORS WITH ONE-COAT COVERAGE...

"Say—this new DULUX sure does hide!"

HERE'S the finish you have been waiting for!

DULUX High-Hiding Mill White has all the qualities that make DULUX different from other finishes... longer-lasting, *whiter* whiteness, lower application cost and greatly lowered maintenance costs.

But in addition to these advantages, DULUX High-Hiding Mill White has another: On many surfaces in good condition, it gives satisfactory results with *only one coat!* Except when present finish is in very poor condition, just one coat of DULUX High-Hiding Mill White will do the job you want. If the present surface is in very bad condition, it may be necessary to apply a priming coat first.

Since normally it requires only one coat, you will need far fewer gallons per job and less time in application. And because of the amazing durability and whiteness retention of DULUX, you will need fewer repaintings. Thus you save on application and on overhead.

For full information about this new finish, just send in the coupon.

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HIGH-HIDING MILL WHITE

E. I. du Pont de Nemours & Co. (Inc.), Dept. **FM-109**
Finishes Division, Wilmington, Delaware

Please see that I get complete information about DULUX High-Hiding Mill White—and your new booklet.

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the product depended entirely on what one did to those same handles.

A visitor in the training room of the Norton Company of Worcester, one of the pioneers in vestibule training, asked one of the students where he came from. He said he had been a Turkish bath attendant up to about a week before. A few days later he went into the shop and ran a horizontal milling machine. Which would seem to sum up the case for the vestibule school: It turned an office worker, a housewife, a school teacher —in fact, anyone with normal alertness and strength—into a competent machine operator in double-quick time.

Plant Sabotage

(*Continued from page* 58)

firmed in the post-war writings of a well-known foreign agent who participated in certain activities in this country during the war and later served a sentence in a federal prison.

The "incendiary pencil" was perhaps the most ingenious of the alien arsonist's tool. It was literally a pencil split open, with the lead removed and a glass tube inserted. Powerful chemicals were contained in each end of the tube which was drawn to capillary dimensions at the center. When the tip of the pencil was broken, the chemicals united, producing a white-hot flame.

Also widely used, but more complex in construction and more difficult to plant, was the "thermit," consisting of two small bricks of compressed metal filings with hollowed centers and a device between them set to go off at a given time. In action the thermit formed a mass of molten metal capable of burning through steel plates.

In maritime sabotage, the "cigar" bomb, planted while ships were at dock, caused countless fires far out at sea. The "cigar" was simply constructed by a piece of lead pipe containing different chemicals at the ends and divided at the center by a disk of copper. As the acids ate through the copper, the chemicals met and explosion took place. The detonation was timed by the thickness of the disk. Later spies learned how to fit bombs, connected by rods, to the rudders of ships. Each swing of the rudder blade contributed to the winding of a mechanism which eventually fired a charge of TNT. Some of these bombs merely blew the rudders away. Others contained enough explosives to shatter the hull of a dreadnought.

Meal Turned Blue

In industrial plants, attempts to damage goods or raw materials were frequent. Methods varied in accordance with the product. A typical example of the saboteur's ingenuity was the dropping of methyline capsules into shipments of corn. When the corn was milled, the meal was turned blue and rendered worthless. In many munitions plants, dynamite caps and bombs were found in shipments of scrap metal.

As the vigilance of industry and government agencies increased, however, the effectiveness of the saboteurs diminished. Already forewarned, industry, it is hoped, will forestall serious loss this time.

Here are four pointers suggested by the National Fire Protection Association, which observes that the exact means by which a fire is started is "not likely to be of great practical importance."

"The main thing is to depend upon the application of sound principles of fire protection," the Association says. "These include: (1) Keeping the amount of material to burn in one place as small as possible; (2) providing construction that tends to retard the spread of fire such as use of fire doors, fire walls, and the like; (3) employing fire protection equipment such as automatic sprinklers, automatic fire alarms, and

Uniform Results . . . Lower Costs with Ryerson Certified Alloys

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All Ryerson Certified Alloys are analyzed and tested in advance. Special data sheets showing exact chemical analysis, grain size, cleanliness rating, and results of actual heat treatment tests, are prepared and sent with every shipment. You know exactly what you are getting. Your heat treater does not have to test. He takes no chances. Spoilage is eliminated and sound dependable jobs of high accuracy and uniformity are secured.

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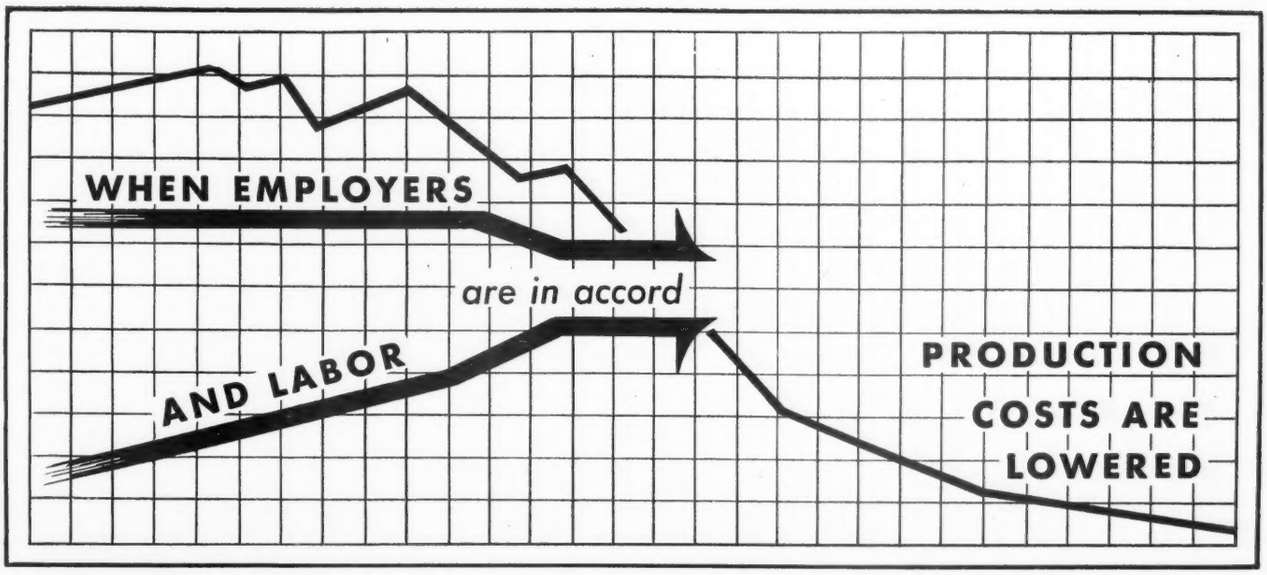


Skilled NATIVE-BORN LABOR is PLENTIFUL and COOPERATIVE

in Chesapeake and Ohio Territory

Industries considering new locations in Virginia, West Virginia, Kentucky, Ohio and Indiana—the states served by Chesapeake and Ohio Lines—will find labor resources a favorable factor. Skilled and unskilled, white and colored, labor in this area is abundant and especially adaptable to the metallurgical, chemical, paper, ceramic, food-processing, textile and heavy-duty industries.

Drawn from a largely agricultural population, the typical worker is native-born, self-respecting, proud of his home, family, job and community. This desirable type of labor is so plentiful throughout Chesapeake and Ohio Territory that industry need not devise means to attract outside labor.

Labor, then, may be set down in the list of *Economy Factors* —along with abundant raw materials, available industrial sites, easily accessible markets, cheap power, excellent transportation and business-minded legislation—which make this region desirable for a great diversity of industries.

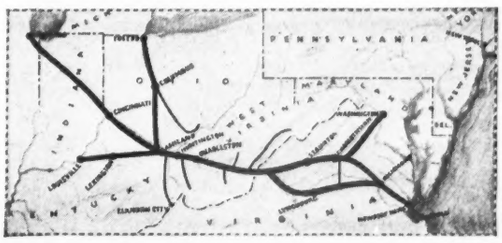
THESE ADVANTAGES

are but the fundamentals of many favorable conditions making Chesapeake and Ohio Territory an economic field of operation for many industries.

- RAW MATERIALS of many kinds; abundant, near at hand, economically secured.
- INTELLIGENT LABOR—native-born; largely skilled in a diversity of industries; well housed; peaceful and cooperative.
- NEAR TO MARKETS—major consuming areas within first, second or third morning delivery.
- EXCELLENT TRANSPORTATION—favorable freight rates and dependable service keep markets and manufacturers in economically close touch.
- CHEAP POWER—abundant coal, oil, natural gas and hydro-electric developments assure this region of unlimited power at most economical costs.
- COOPERATIVE LEGISLATION—Industry is king in Chesapeake and Ohio Territory, and the legislatures of the five great States in which it lies are friendly toward the needs and aims of enterprises they invite and those they already have.

What do you seek in a more advantageous location? Complete and impartial factual surveys for your specific industry will be furnished on request. All inquiries will be held in strictest confidence. Write

GEORGE D. MOFFETT, *Industrial Commissioner*
CHESAPEAKE AND OHIO LINES, Huntington, W. Va.



CHESAPEAKE and Ohio LINES

fire extinguishers; (4) using adequate and efficient watchman service.

Safety experts emphasize the necessity for adequate fencing of plants and guarding of gates. The Safety Research Institute urges that fire extinguishers be grouped at points where special hazards exist to cope with the full extent and type of fire that may be anticipated.

Extinguishing units for every 1,000 square feet of floor space and within 50 feet of travel distance from any point are recommended for ordinary occupancies. All watchmen and employees should be trained in the use of extinguishers, fire brigades formed, and frequent inspections of equipment made.

Methods of guarding against sabotage were described in FACTORY for June, 1918, by Arthur Van Vlissengen, who emphasized that "your own loyal employees are your best guard" once they have been informed of the hazard and an appeal has been made to them both on grounds of patriotism and self-interest. Care in hiring new employees was urged. Many undesirables were turned away at the gate of one plant by a rule requiring applicants to fill in form letters of inquiry to their previous employers. In many plants, employees were required to wear badges, and special tags were issued to visitors so that no stranger could go very far unchallenged. Since most mysterious fires and accidents occurred at night, management was strongly urged to keep bright lights burning throughout the buildings and at all approaches to the plant.

Four points for plant protection laid down by the War Department at that time were: (1) Each day conduct a thorough examination of the plant from roof to cellar and have floor bosses and supervisors check frequently throughout the day; (2) make a careful scrutiny of all persons leaving and entering the plant, and insist on identification badges; (3) personnel managers should keep careful tabulations on all employees, check citizenship and past records, and keep watch for possible sources of danger; (4) management should enlist the cooperation of trusted and loyal employees in maintaining constant vigilance.

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CAN BE REDUCED!

The correct oil film to each individual bearing... automatically

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AUTOMATICALLY Correct LUBRICATION

● SPOILAGE annually running into millions . . . Roving, yarn and cloth stained—often ruined—by oil! Yet many progressive mills already have proved that every machine bearing now served by a Bijur Automatic Lubricating System has the oil feed under perfect control. A closed system . . . no drip, no drainage. Damage by oil—waste of oil . . . both eliminated. Each bearing is unfailingly lubricated, correctly and automatically, with the metered oil film required.

Specify all your new machines BIJUR-EQUIPPED. It pays!

BIJUR LUBRICATING CORPORATION LONG ISLAND CITY, NEW YORK

888

Conveyor Paid Out in 2 Years

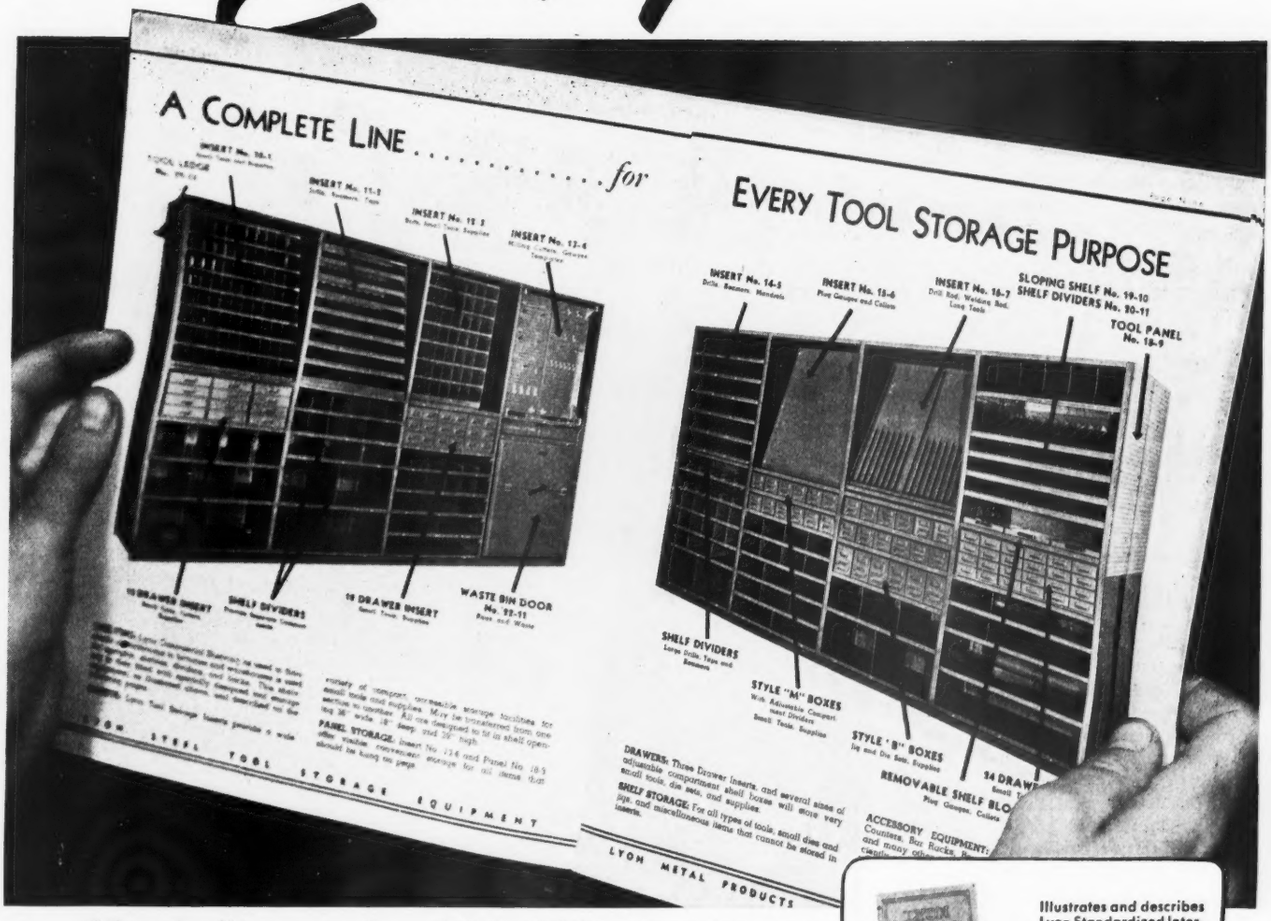
(Continued from page 47)

fortably without the services of six or seven men on these two operations of getting goods from machine to stock to car, and of getting incoming goods to where they will be used. Along the way we have saved a good deal of wear and tear on floors, and have greatly speeded up the transit of finished goods —which is of major importance when we need them for loading cars.

At the ends of the lines in the packing room are located portable sections of gravity roller conveyor to take away the cartons as they come off the gluers. There are six packing lines, and five feeder conveyor lines leading from them. The answer to this discrepancy in numbers is that two of the six packing lines handle comparatively small production of small units, and one feeder line is sufficient for their output. With a portable section, the people on the floor allow a volume of packages to accumulate on the section of conveyor at the end of one of these small lines, while the output of the other small line is running on the conveyor. Then they transfer the portable section to the other machine line and let the other line's production pile up in the same way for a while. The four major packing lines have a feeder line apiece, working full time.

These gravity roll sections lead from the machine lines around a bend. There each one has a belt booster which raises the goods several feet so that they can be once more handled by gravity. At the far end of the room the five

"THAT'S *Exactly* WHAT I WANT!"


A COMPLETE LINE . . . . . for
EVERY TOOL STORAGE PURPOSE
INSERT No. 14-5
INSERT No. 15-6
INSERT No. 16-7
SLOPING SHELF No. 19-10
SHELF DIVIDERS No. 20-11
TOOL PANEL No. 18-9
SHELF DIVIDERS
STYLE "M" BOXES
STYLE "B" BOXES
REMOVABLE SHELF BIN
ACCESSORY EQUIPMENT:
DRAWERS: Three Drawer inserts, and several sizes of adjustable compartment shelf boxes will store very small tools, die sets, and supplies.
SHELF STORAGE: For all types of tools, small dies and jigs, and miscellaneous items that cannot be stored in inserts.
LYON METAL PRODUCTS
INSERT No. 10-1
INSERT No. 11-2
INSERT No. 12-3
INSERT No. 13-4
10 DRAWER INSERT
WASTE BIN DOOR No. 22-11
SHELF DIVIDERS
PANEL STORAGE: Insert No. 17-4 and Panel No. 18-5
STEEL TOOL STORAGE EQUIPMENT

● Recently a Western manufacturer and a Lyon salesman were leafing through our new Tool Storage Catalog. When they reached the spread illustrated above, the manufacturer paused for a closer inspection, then said: "Man alive! That's EXACTLY what I want!"

Here's an example of why most manufacturers will find an inspection of the Lyon Catalogs shown below, time profitably invested. They show equipment that offers a practical, money-saving solution to a wide range of materials handling and storage problems.

Often, of course, the complete solution of how to lower storage and handling costs is beyond the scope of a general catalog. That's where Lyon Storage Engineers enter the picture . . . building definite and complete recommendations on a systematic survey of your present equipment and methods . . . and your specific needs. Such surveys frequently unearth serious and unsuspected production cost losses, transportation cost losses, storage space wastes, fire hazards, stock and tool losses and personal injury hazards . . . show how to eliminate such losses and hazards . . . how to effect savings that quickly pays for modernizing equipment and methods.

Take the first step today. Mail the coupon for one or all of the Lyon Catalogs shown here. Then, if you don't find "exactly what you want," ask for full facts about a no-cost, no-obligation survey by a Lyon Storage Engineer.

Illustrates and describes Lyon Standardized Interchangeable Steel Shelving for every industrial and commercial storage need.

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A complete showing of industry-proved Steel Shelf and Shop Boxes and Specialized Steel Containers for handling materials.

The Lyon Steel Locker Line offers the most advanced features in design and construction, provides suitable units for every clothes storage need, meets today's requirements for clothes storage facilities that promote employee good will.

LYON *STORAGE EQUIPMENT* *Service*

LYON METAL PRODUCTS, INCORPORATED, *Aurora, Illinois*

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Please send Catalogs: ☐ Steel Shelving; ☐ Shop Boxes; ☐ Steel Lockers; ☐ Tool Storage Catalogue

Name _____

Address _____

City _____ State _____

feeder lines pass through a wall to a transfer station.

Here each line has a block to prevent its emptying itself. At right angles runs what we call our trunk conveyor line, to which the feeder lines contribute. Here stands the girl already mentioned. She knows what goods are required where, and in what quantities. Suppose, for example, that a car is being loaded that requires twice as many packages of Glo-Coat as of Wax Paste. She lets perhaps 12 cartons of Wax Paste pass to the trunk conveyor from the Wax Paste feeder, then 24 cartons of Glo-Coat from the Glo-Coat feeder, and so on. She does it by pushing a button which controls the end block on each line, and counting the packages as they pass.

After the conveyor was installed, we found there was a real need for a method of communication between her and the stockroom, so we gave her an intercommunicating loudspeaker device by which she can call them or they can call her, and exchange information without anybody leaving the working post. The girl at this transfer point likewise keeps an eye on the packages, and puts a little additional glue on any that are not properly sealed.

This station is the end of the five feeder lines. From here the packages travel on the trunk conveyor line. It leads upstairs to a stockroom, at the second floor traveling just beneath the ceiling. Every few feet there is a take-off station at a cross-aisle. These stations are fitted with swing gates, so that a stockman diverts to his take-off chute any packages that would be stocked there. He puts the packages on skids. Here is where we still use the half-time services of an electric lift truck.

Our original plan had been to stack finished goods right on the floor, drop them through trap doors and chutes to the first floor for shipping. But experience demonstrated that we save enough handling of individual packages to repay stacking the cartons on skids and using an electric lift truck and the elevator to get them down to the shipping floor.

The trunk-line conveyor travels overhead the entire length of the stockroom building. There are taffe-off stations at the cross-aisles. But also, at the far end, it leads to a chute which runs directly to the loading platform. When we are loading a car that needs goods at that moment coming off the machines, the stock men permit these goods to travel all the way, and thus to the cars. On the loading platform portable conveyor sections deliver the goods right into the car. It should also be mentioned that several spiral chutes lead from take-off stations on the second floor direct to carloading stations on the first floor, so that we can use the system for simultaneous loading of several cars.

The actual dollars-and-cents savings resulting from this 750-foot conveyor installation have never been definitely computed. We know, however, that the savings in labor alone are sufficient to repay the total installed cost in about two years—not to mention the savings in floor space, and other incidentals. It has proved an exceedingly profitable investment in equipment.

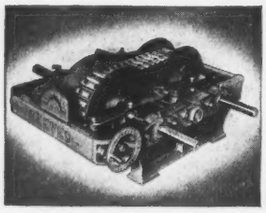
WHO IS THE "BOSS" the MAN, or the MACHINE?

● In thousands of industrial plants certain machines stubbornly refuse to do things except in their own way—at their own pace.

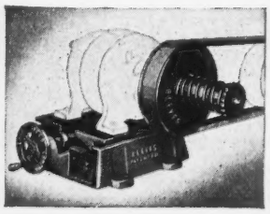
They have one set speed, and they stick to it—through thick and thin!

Alongside these machines are others, equipped with REEVES Variable Speed Control. *They* respond to every demand for change of pace to meet changing conditions and materials, to process or manufacture different sizes and shapes of products, to match the operator's skill, to keep "in step" with other machines in the production line. The operator merely turns the REEVES handwheel to get any speed he needs—even to a fraction of a revolution—and that exact speed is maintained as long as he desires.

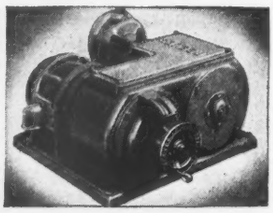
There is no question which of these machines is the more profitable. REEVES Variable Speed Control makes any production machine a better investment. Why not let the REEVES representative in your territory look over the machines in *your* plant, and make recommendations? No obligation. Write us today. REEVES PULLEY COMPANY, Dept. F-109, Columbus, Indiana.



VARIABLE SPEED TRANSMISSION. Provides infinite speed adjustability over wide range. Accurate and positive at all speeds. Modern, compact open and enclosed designs, vertical and horizontal. Fifteen sizes—fractional to 100 h. p. Speed variations from 2:1 to 16:1 inclusive.



VARI-SPEED MOTOR PULLEY. Simplified development of Transmission. Mounts on standard shaft of any constant speed motor. Forms direct drive to machine. Sliding motor base is moved forward or back for speed changes. Seven sizes—fractional to 7½ h. p., 3:1 range of variation.



VARI-SPEED MOTODRIVE. Combines in one compact, self-contained enclosure, constant speed motor, REEVES speed varying mechanism and reduction gears (where required). Available in space-saving horizontal and vertical types—¼ to 10 h. p. Speed variations 2:1 to 6:1 inclusive.

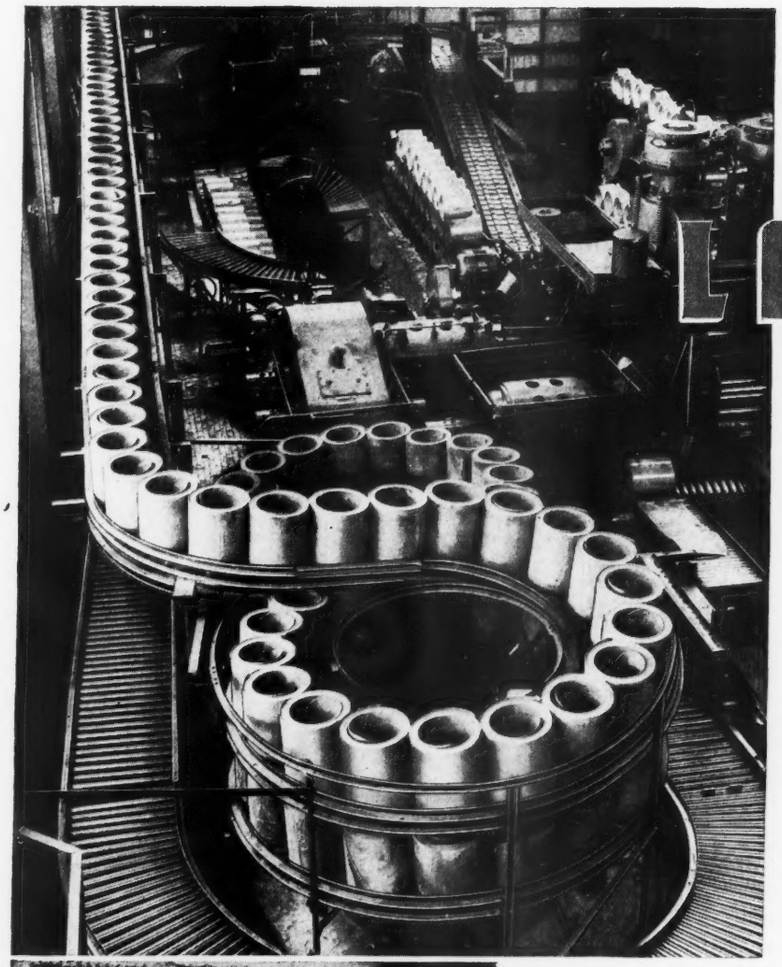
REEVES SPEED CONTROL

BOOKS

OPERATION ANALYSIS

Harold B. Maynard, President, Methods Engineering Council; G. J. Stegemerten, Staff Supervisor, Time Study and Methods Dept., Westinghouse Electric & Mfg. Co. McGraw-Hill Book Co., Inc., 330 West 42d St., New York. 298 pages, index. $3.

Describing the procedure for conducting operation analyses, this book is for use by foremen, tool designers, inspectors and other shop supervisors, and methods engineers in analyzing operations and determining procedures that are more economical, efficient, and easy to perform. Emphasis is laid on the applicability of operation analysis and how to determine the amount of analysis work which is economically justified on any job. Some topics discussed are limitations of operation analysis, purpose of operation, list of operations performed on part, inspec-



78,000 Pounds of Brass

Moving Easily on This

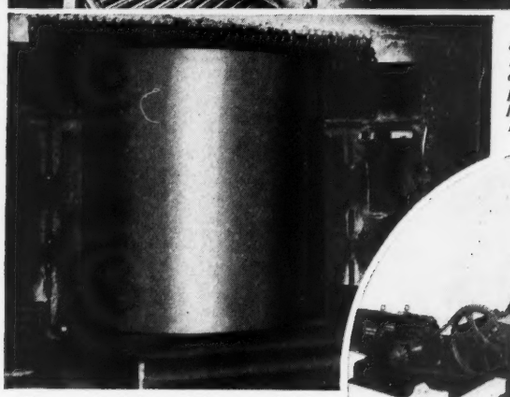
LAMSON

Heavy Duty ROLLER CONVEYOR

Used as a storage reservoir, this LAMSON Heavy-Duty ROLLER CONVEYOR in the new brass mill of Revere Copper and Brass Incorporated at Rome, N. Y., supports and handles great weights with ease and precision. As they come from the run-down mill, the 800-pound rolls of sheet brass are elevated by power conveyors to the upper conveyor level. Here they remain until selective switches release them to move by gravity either back to the mill for further passes, or to storage, or to the annealing furnaces.

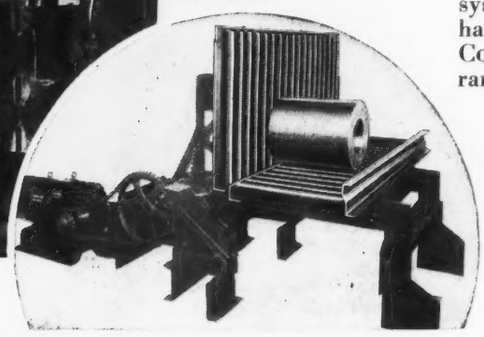
The speed and smoothness with which the various operations are carried out—from up-ending the rolls as they come from the mill to depositing them in the furnace—all reveal the perfection of design and manufacture developed by LAMSON during 50 years of conveyor experience. Liveliness and long life of the rollers, plus a wide range of equipment that fits the conveyor system to the space requirements and handling needs of the plant, make LAMSON CONVEYORS preferred equipment in a wide range of industries.

MAIL THE COUPON now for Lamson's new conveyor book, prepared especially for plant engineers and production executives. It describes the latest gravity, belt, vertical, live roll, slat, drag chain, overhead chain and special type conveyors.

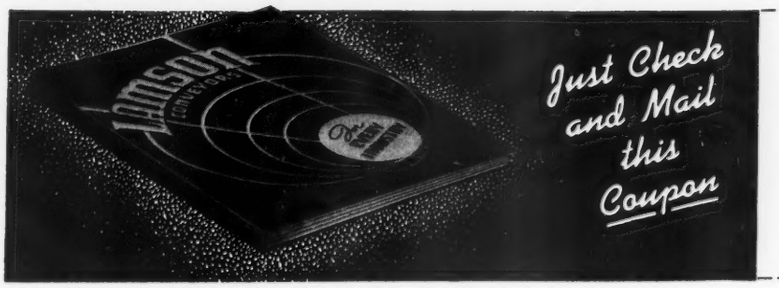


Shows coil of brass being moved into annealing furnace by Lamson Gravity Conveyor.

View in the new Revere Copper & Brass Mill shows how Lamson Heavy Duty Conveyors act as a storage reservoir for heavy brass coils. Below: Close-up of one of the Lamson Down-enders in the new Revere Mill.



LAMSON CONVEYORS



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Company.....

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tion requirements, material, material handling, set-up and tool equipment, ten common possibilities for operation improvement, and working conditions and method. Check sheets, analysis sheets, process charts, and progress charts are referred to.

ADDRESSES ON INDUSTRIAL RELATIONS—1939

Bulletin No. 9, Bureau of Industrial Relations. University of Michigan, Ann Arbor, Mich. 132 pages. $1.

Summaries of a number of the addresses delivered at the annual Industrial Relations Conference sponsored by the University of Michigan and held in April, 1939, include topics concerning essentials in an employer's labor policy, getting company policies across to employees, sensing employee attitudes, making collective agreement work, layoff policy, time study in a union shop, rating employees, and medical care and sickness benefits for employees. Pages are mimeographed.

PROTECTIVE COATINGS FOR METALS

R. M. Burns, Assistant Chemical Director, Bell Telephone Laboratories; A. E. Schuh, Director of Research, U. S. Pipe and Foundry Co. Reinhold Publishing Corp., 330 West 42d St., New York. 407 pages, author index and subject index, illustrations, diagrams. $6.50.

This monograph replaces and extends the scope of Dr. H. S. Rawdon's monograph of 1927, entitled *Protective Metallic Coatings*, which has been completely rewritten to cover coatings of all types including paints. Intended primarily for those who have problems of protection, this volume, although not intended to be a manual for the production of protective coatings, contains considerable information on the production phases of the subject. Topics covered concern protective coatings and the mechanism of corrosion; surface preparation for application of coatings; types of metallic coatings and application; zinc, cadmium, tin, nickel and chromium, copper, lead, and aluminum coatings; coatings of noble and rare metals; methods of testing metallic coatings; composition of paints and mechanism of film formation; durability and evaluation of paints; paint practices; miscellaneous coatings.

GETTING ALONG WITH LABOR

Leigh S. Plummer, Labor Editor, *The Wall Street Journal*. Harper & Brothers, Publishers, 49 East 33d St., New York. 112 pages, index. $1.50.

Personnel programs of eleven American industrial corporations that were almost entirely free from labor trouble in 1936-37 are presented by the author with the hope that other companies and industries will find in them practical suggestions for their own industrial relations problems. Recent trends in industrial relations practice, methods for coping with regulatory legislation, and the policies of such companies as R.C.A. in getting along with the C.I.O., Standard Oil of New Jersey, Eastman Kodak Company on a wage-dividend plan, Proctor & Gamble Company on a system of guaranteed employment, Westinghouse Electric & Mfg. Co., and others, are discussed.

PROCEEDINGS OF THE THIRD ANNUAL TENNESSEE INDUSTRIAL PERSONNEL CONFERENCE

James H. Williamson, Secretary-Treasurer, Tennessee Industrial Personnel Conference, University of Tennessee, Knoxville, Tenn. 318 pages. $1.

Nashville Meeting, March, 1939. Speeches presented at the conference and contained in this book deal with personnel administration, trends, functions in a small plant, and management in the office; training problems; programs of health and safety; savings plans; merit rating; social legislation; human psychology; job classification; and Southern industry.

THE PREVAILING MINIMUM WAGE STANDARD

O. R. Strackbein, Member, Public Contracts Board, U. S. Department of Labor. Graphic Arts Press, Inc., 914 20th St. N. W., Washington, D. C. 187 pages, reference list, tables. $2.50.

This study of the Public Contracts Act, the wage standard established by the United States Government for the purchase of its supplies, contains an analysis of the act; discusses the prevailing minimum wage and wage standard; goes into the question of "locality;" presents wage determinations under the act in the iron and steel, aircraft, soap, and cement industries; and concludes with an evaluation of the act.

SEVENTH INTERNATIONAL MANAGEMENT CONGRESS—PAPERS

Nathaniel W. Barnes, Secretary Seventh International Management Congress, 347 Madison Ave., New York, Rm. 1201. Bound as seven paper-covered volumes totaling approximately 1,000 pages. $3.75, postpaid in the United States, for complete set.

Titles of the volumes as follows: Administration; Production; Personnel; Home Management; Distribution; Agriculture; Proceedings. An imposing array of American and European authors.

THE FIRST FIFTY

F. Lawrence Babcock, Associate Editor, *Fortune*. Standard Oil Co. (Indiana), 910 South Michigan Ave., Chicago. 57 pages, illustrations.

The history of the first fifty years of the Standard Oil Co. of Indiana is told not only as the story of a corporation, but also as the story of an industry and of the changing ways of the American people from 1889 to the present. Some-

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COLLOIDAL GRAPHITE
The use of suitable oils containing "dag" colloidal graphite provides a super lubricant which functions surely and effectively under the high temperatures met in some industrial operations.
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We are asked that question occasionally . . . regarding our Guarantee that VIM Leather Packings will last twice as long as any other leather packing, when properly installed. Here's the way we answer:

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thing of the interaction of the discoveries and inventions that led to the Modern Age is shown. The story of early discoveries is only the beginning of this "yarn" that spins on to tell of the production, piping, refining, and marketing of oil. With a picture on every page, it is a vivid presentation of the oil industry to those unfamiliar with the industry, and to financiers, industrialists, and scientists.

THE COLLECTIVE LABOR AGREEMENT

Elias Lieberman, Member of the New York and Federal Bar, Counsel for International Ladies' Garment Workers' Union, etc. Harper & Brothers, Publishers, 49 East 33d St., New York. 233 pages, bibliography, index of cases cited, and index of clauses. $3.

To aid business executives, union officials, and others interested in making collective bargaining work, this book explains how to negotiate and draft the contract. Based on actual labor agreements concluded in more than 130 industries ranging from workers to white-collar and professional fields, it is divided into two parts. The first part deals with the historical background, legal status and methods of negotiating labor agreements. The second part deals with the drafting of the agreement and contains specimen clauses with notes on problems and legality. Issues arising in formation of contracts are discussed.

THE CASE AGAINST EXPERIENCE RATING IN UNEMPLOYMENT COMPENSATION

Richard A. Lester, Assistant Professor of Labor, College of Economics and Business, University of Washington; Charles V. Kidd, Social Security Board. 60 pages, list of references. $1.

Last May we told about the case for experience rating in unemployment compensation. Now the case against experience rating, as viewed by its critics, has been written up to show the "contradictory" nature of the basic arguments for such rating.

•

ON THE CALENDAR

OCTOBER

1939 Show of the National Machine Tool Builders Association, scheduled to be held in Cleveland from October 4–13, has been indefinitely postponed. Mrs. Frida F. Selbert, Secretary, 10525 Carnegie Ave., Cleveland.

16–20, National Safety Council, 28th National Safety Congress, Atlantic City, N. J. W. H. Cameron, Secretary and Managing Director, 20 North Wacker Drive, Chicago.

18–20, Porcelain Enamel Institute, Fourth Annual Forum, Columbus. Frank E. Hodek, Jr., Chairman of the Forum Committee, Porcelain Enamel Institute, 612 North Michigan Ave., Chicago.

22–27, American Welding Society, Annual Meeting, Chicago. M. M. Kelly, Secretary, 33 West 39th St., New York.

23–27, National Electrical Manufacturers Association, Annual Meeting, Chicago, R. J. Blais, Convention Manager, 155 East 44th St., New York.

NOVEMBER

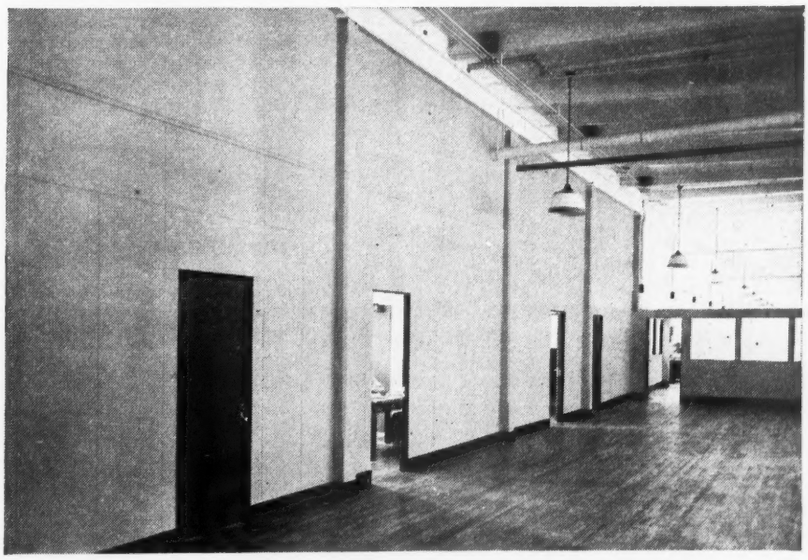
3–4, Industrial Management Society, National Motion and Time Study Clinic, Chicago. W. F. Entorf, Publicity Chairman, Industrial Management Society, 205 West Wacker Drive, Chicago.

DECEMBER

4–8, National Association of Manufacturers, Annual Congress of American Industry and National Convention, New York. Noel Sargent, Secretary, 14 West 49th St., New York.

ANY PLANT CAN SAVE WITH OFFICES LIKE THESE

TYPICAL "TRANSITE" OFFICE in the Schenectady Plant of General Electric Company. Providing all the solidity and privacy of fixed partitions, Transite Walls are erected without dirt or disturbance. The simple construction method makes relocation equally easy . . . permits 100% salvage of materials.



MADE OF ASBESTOS AND CEMENT, Transite Walls cannot burn or rot. Their unusual strength and durability guard against denting or cracking. Even under severe service conditions, maintenance is held at minimum figures.

Easy and economical to install, J-M Transite Walls form permanent, quiet factory offices . . . can be quickly relocated with no loss of material . . .

YOU meet none of the usual construction troubles when you build plant offices with J-M Transite Walls. Initial installation is rapid and dry . . . large, easily handled sheets are erected by an ingenious construction method that eliminates dirt and disturbance. This same method permits equally simple relocation whenever changes are necessary.

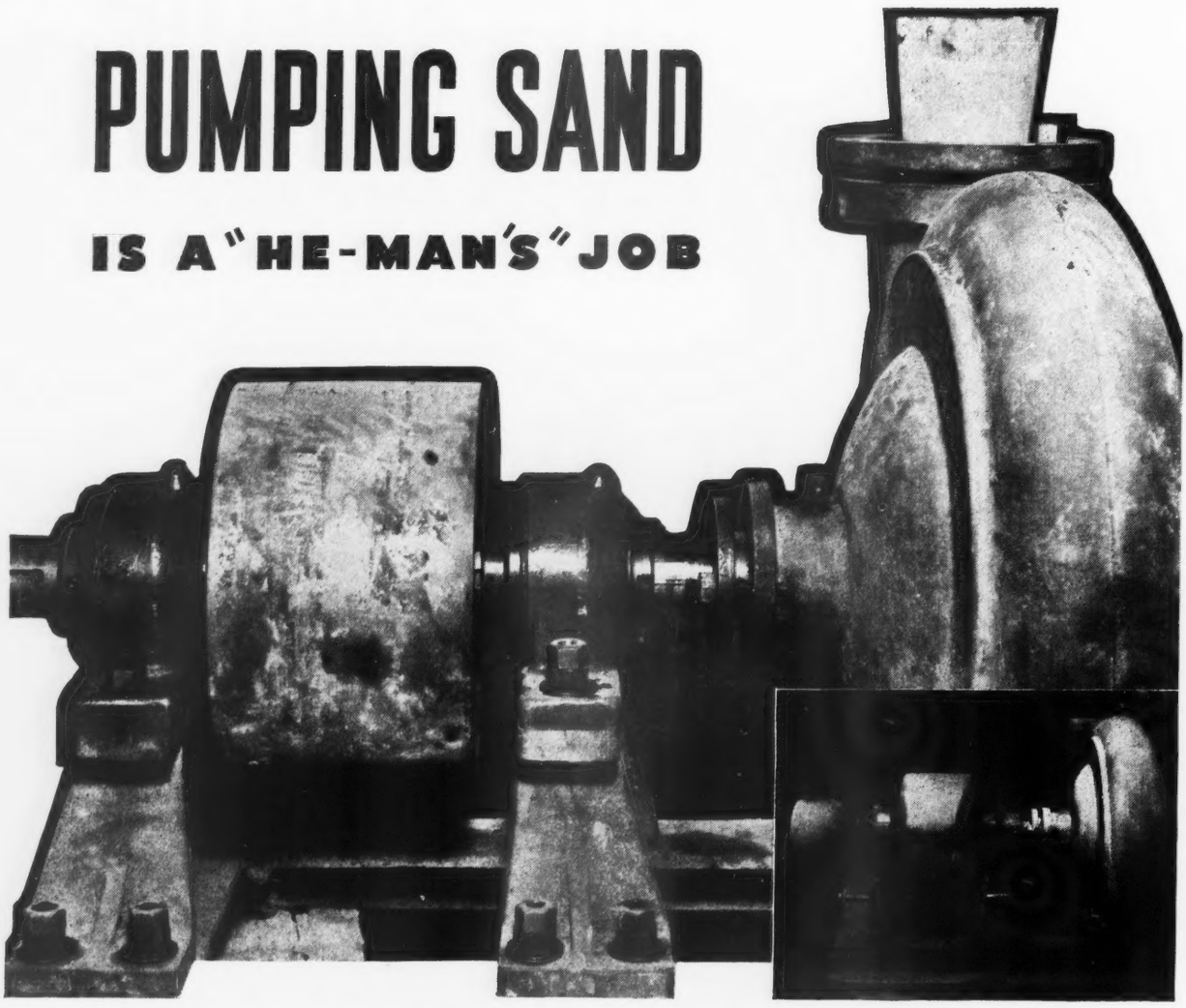
Finished offices are permanent, for Transite Walls are made of asbestos and cement . . . fireproof, rotproof, unusually strong and durable. Maintenance is exceptionally low. And, because this modern partitioning material is highly resistant to sound-transmission, it assures quieter, more efficient offices.

It will pay you to get full details. Write for the new Transite Walls brochure. Johns-Manville, 22 East 40th Street, New York, N. Y.

Johns-Manville TRANSITE WALLS

PUMPING SAND

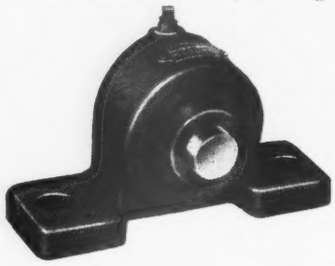
IS A "HE-MAN'S" JOB



FAFNIRS CUT COSTS AT GOLDEN CYCLE MILL...

THE JOB is to pump 900 tons of sand per day, over a distance of about ¼ mile, with a rise of 200 feet. Operation, 50 minutes out of every hour, 24 hours a day. The old plain-bearing pumps lasted, as an average, for only 16 days, with failure always traceable to the bearing.

Then Golden Cycle Mill, Colorado Springs, Colo., substituted standard Fafnir SAODD 2 3/16" Pillow Blocks on the pump causing the most trouble. This pump is now taken out of service only to renew any worn parts — averaging three months' service, or better, in these intervals. And here are the figures on maintenance savings: it took two men two days to recondition the old type pump. With Fafnirs on the job, it takes *one* man *seven hours.*



Result: Golden Cycle Mill is effecting a rapid change-over to Fafnir-equipped pumps—fifteen in all. And now that Fafnir Bearings carry the loads it will be possible to cut the number of "spares" by 30%.

Proof again that there's a worthwhile saving awaiting every bearing user who chooses from the extensive Fafnir line. And that modernization with Fafnirs always results in a better than average job. Write for literature on Fafnir Transmission Units — easiest to install of all ball bearing units. The Fafnir Bearing Co., New Britain, Conn.

FAFNIR BALL BEARINGS

THE BALANCED LINE • MOST COMPLETE IN AMERICA

YOUR MEN...

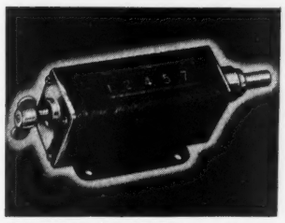
AND YOUR GIRLS

Both can COUNT YOU IN on Closer Cost-Control with Veeder-Root Counting Devices

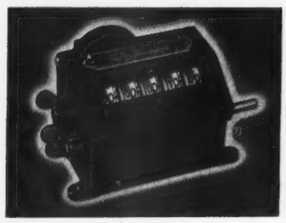
Know the exact productive ability of every machine and operator in your plant and office . . . and you'll know how to schedule your work, control your costs and figure your maintenance more accurately than ever before.

In every line of industry, Veeder-Root Counters are providing hourly, daily or weekly records on every type of production and business machine. These devices will count, measure or control in any terms or units you want . . . operations, revolutions, strokes, starts, stops, trips, speeds, lengths, volumes, hand-movements, light-flashes, etc.

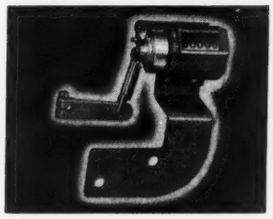
And it may be too, that . . . built into your product . . . they can increase its utility, and so widen its market and increase its sales. In innumerable ways, there are surprising profits to be uncovered by "facts-in-figures." Many interesting instances are given in our booklet "Counting Devices." *Write for it today.*



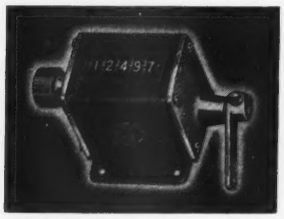
FOR HIGH SPEED WORK This High Speed Resetting Counter operates at 8,000 counts per minute in direct-drive type . . . 2,000 in revolution type.



CONTROLS MACHINE RUNS This Predetermining Counter prevents over-runs and shortages on winders, fast automatics, etc., running at speeds up to 2500 R. P. M.



ACCOUNTING & TYPING This Production Computator records each keystroke on typewriters and accounting machines. Provides basis of wage-payment.



FOR OFFICE AND LIGHT PRODUCTION MACHINES Small Reset Counters count strokes or revolutions. May be furnished with totalizing register.

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You can make a 2 ft. square pocket cut in Celotex sheathing in ONLY 45 SECONDS!

COSTS GO DOWN WHEN YOU CUT COMPOSITIONS WITH SKILSAW!

ONE FOOT PER SECOND! . . . that's how fast SKILSAW cuts Celotex! Industry uses SKILSAW to save time, save material handling, save labor costs wherever cutting has to be done on Transite, Masonite, Bakelite panels, ebony asbestos—for product fabrication, general insulation and in construction operations.

In every industry, SKILSAW is the preferred electric handsaw because it has more power, is built stronger, will do more sawing jobs. Plugs into any light socket. 9 POWERFUL MODELS for cutting wood, metal, stone and compositions.

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SKILSAW
PORTABLE ELECTRIC TOOLS
SAVE MONEY IN EVERY INDUSTRY!
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Sold by leading distributors of mine, mill, hardware and contractors' supplies.

SKILSAW
SAVES TIME and MONEY IN EVERY INDUSTRY!

• Cuts lead 1 in. thick at the rate of *2 ft. per minute!* Also cuts copper, aluminum, steel and lead-covered cable.

• Rips out 60 ft. of old 3 in. maple flooring in *10 minutes!* This would take 2½ hours with hand saw and crowbar.

• Grooves upright staves in wood tank manufacturing. One user *saves $24 a day* cutting grooves 2 x 1¼ in. deep.

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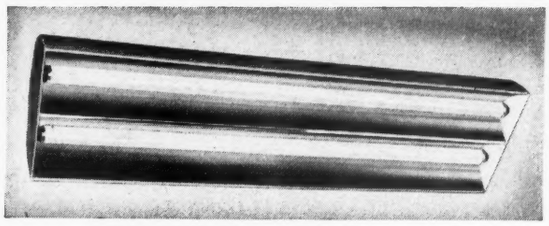
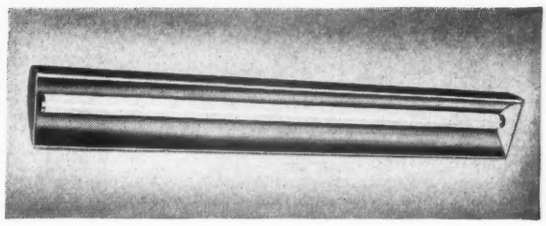
Bring Better Industrial Lighting . . . . . .

1. **An Extended Light Source!**
2. **Accurate Color Rendition!**
3. **Greater Efficiency!**
4. **Low Brightness!**
5. **50% Cooler Light!**
6. **Longer Lamp Life!**
7. **Ease of Installation!**
8. **Ease of Maintenance!**



Two-Lamp Westinghouse Fluorescent Reflector



One-Lamp Westinghouse Fluorescent Reflector

Westinghouse designed this new Reflector line to provide THE BEST POSSIBLE FLUORESCENT ILLUMINATION FOR INDUSTRIAL OPERATIONS.

These new reflectors offer everything in one package that industrial executives, plant superintendents and factory managers have wanted in this type of illumination. "Eight reasons why" Fluorescent lighting may be the answer to your plant lighting problem are listed above. They tell only part of the story. You must see these ruggedly-constructed reflectors in operation . . . see the diffuse, glareless illumination . . . see how easily they may be installed and maintained.

This new Westinghouse line incorporates science's latest contribution to industrial lighting. It will pay you to call the nearest Westinghouse Distributor for the complete story, or write Westinghouse Electric & Mfg. Company, Lighting Division, Edgewater Park, Cleveland, O.

Also **The Light that Locks as it Lights.**

Locklite RLM Dome Reflector

The new line of Westinghouse Locklite Reflectors for incandescent lamps offers three distinct advancements in general industrial plant illumination: "THIRTY - SECOND MAINTENANCE" . . . GREATER SAFETY . . . COMPLETE INTERCHANGEABILITY. These two-piece units are simple to install and easy to maintain. A "twist of the wrist" locks the reflector and lamp in place and lights the lamp. Be sure to investigate Locklite today.

Westinghouse Lighting Equipment

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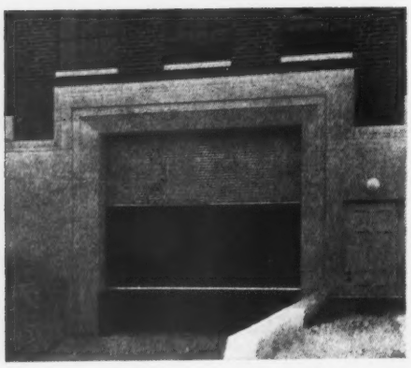
ROLLING GRILLES

Two-Way Protection

OPEN or CLOSED



By using Kinnear Equipment, you can leave a doorway "open" for unobstructed light, air and vision, or close it completely—and either way it will be protected by an all-steel barrier!

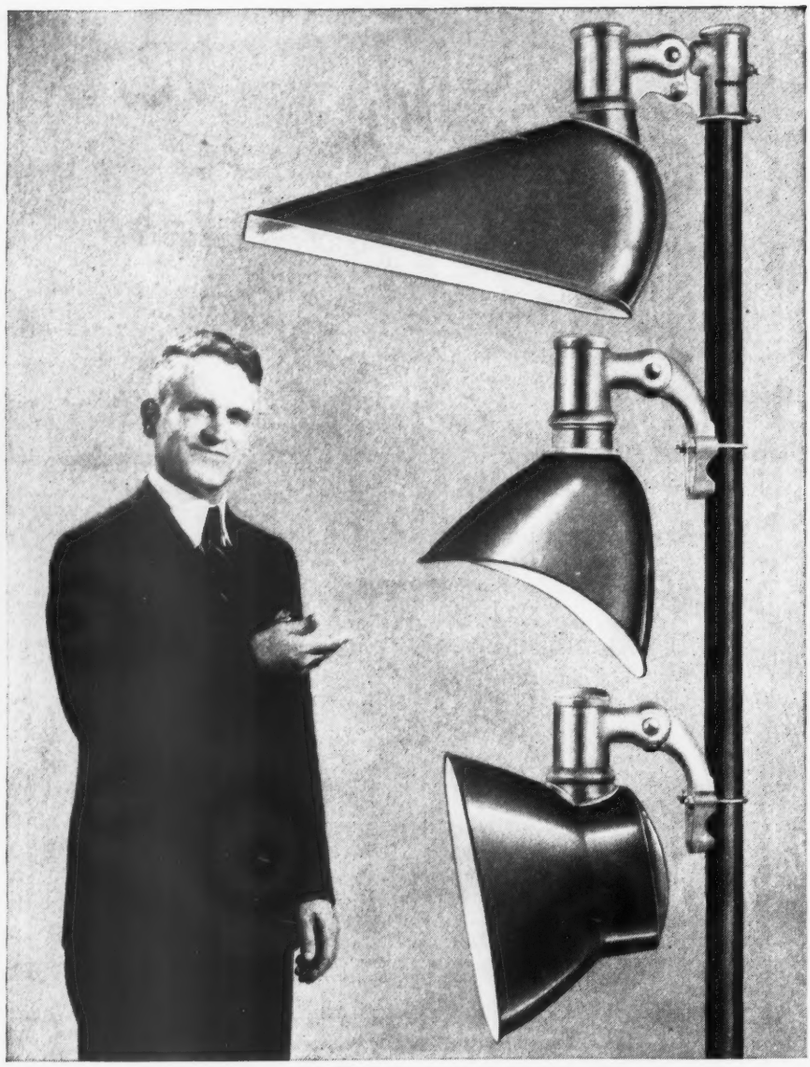
Here's how it's accomplished! Install a Kinnear Rolling Grille in combination with a Kinnear Rolling Door. A mighty convenient and practical form of protection. Both the door and the grille roll up out of the way and out of view when not in use. They coil overhead like window shades, and are remarkably easy to open and close. They require no usable floor or wall space—either for storage or for operation.

It's a protection combination that's economical, too. Kinnear Rolling Doors and Grilles are rugged, heavy-duty units, designed and built to keep maintenance, operation and repair costs at rock-bottom. Both are strikingly attractive in appearance. Made for any doorway in any building. Write for details today.

Offices and Agents in All Principal Cities

THE KINNEAR MFG. CO.
1540-60 FIELDS AVE., COLUMBUS, OHIO
Factories: Columbus, O.; San Francisco, Cal.

KINNEAR
ROLLING DOORS



FLOODLIGHTS

FOR EVERY PURPOSE

by Goodrich

● **Whether you want floodlighting for work areas, play areas, property protection or commercial uses—you'll find exactly the right size and kind among the many styles of Goodrich floodlights. Available for pole or bracket mounting, these porcelain enameled floodlights are equipped with cast aluminum ventilated hood, from which they may be readily removed without disturbing the wiring. This Goodrich feature assures easier installation—easier servicing. All are completely weatherproof, built for lifetime service.**

Goodrich Floodlighting Equipment is described in bulletin No. 71, "Here's How to Light the Night." Ask us to send your copy.

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Building, Construction, and Maintenance Materials

1 **TANK PAINTING** — General instructions and surface preparations necessary when applying tank finishes—how to paint metal, wood and concrete tanks; how to estimate surface areas and amount of paint required on various size and style tanks and supporting structures—are presented in a new folder. American Asphalt Paint Co.

2 **TILE CONDUIT**—Conduit for underground steam or hot water lines is described in an illustrated bulletin—No. 35-67B. Data on cast-iron conduit for reinforcing steam lines under roadways and information on Fiberglas insulation for thermal insulation of underground lines is included. American District Steam Company.

3 **FLOORING**—Features and uses of wood fiber flooring for "traffic" aisles and office floors are pointed out in an illustrated pamphlet. The Hancock Engineering Company.

4 **CEMENTS**—Data and application diagrams on cements for repair of engines, concrete floors and walls, furnaces, pipes; for stopping leaks in joints, stoves, pipe threads, tanks; for fixing cracks in heaters, linoleum, pipes, metal, masonry; are set forth in the 1939 handbook. Smooth-On Manufacturing Co.

5 **MAINTENANCE** — The booklet, "Over the Rough Spots," contains illustrations and answers of help in solving building maintenance problems facing plant men. Stonhard Company.

Compressors, Pumps, Valves

6 **GATE VALVES** — 200-lb. brass gate valves with integral seats and renewable seats are discussed in circular 311 as to construction and materials, service, and general utility. Crane Company.

7 **COMPRESSORS AND VACUUM PUMPS**—Catalog 7502-J presents a new line of industrial compressors and vacuum pumps in sizes from ¾ to 5 hp., and describes new paint-spray compressor units. Installation and shop view of the machines, operating and physical characteristics are included. Ingersoll-Rand Co.

8 **PUMP** — New form, 1917, on motor-driven pump with built-in electric motor shows construction, parts, and applications of the pump. Illustrations are used. Ingersoll-Rand Company.

9 **PUMPS** — New bulletin describes water-lubricated pump having capacity range up to 10,000 gal. per min. Cross-section of the entire pump assembly shows flow of water through the bowls and the method of sealing the impellers by a double seal. Peerless Pump Div., Food Machinery Corporation.

Electrical Equipment

10 **CONTROLS** — Bulletin 40 gives complete information, specifications, prices, application diagrams, on controls—electric floatless liquid level, signal and pump controls, motor starters, relays. Bender Warrick Corporation.

11 **ELECTRIC PRODUCTS** — Condensed catalog, No. 395, contains 88 pages of detailed information on safety switches, service equipment, switchboards, lighting and power panelboards, bus distribution systems. Illustrations, diagrams, and purchasing data are included. Bull Dog Electric Products Company.

12 **SOLENOIDS, COILS, TRANSFORMERS**—Catalog 10 featuring solenoids, coils, and transformers, contains graphs giving technical information and illustrations on applications of solenoids. Dean W. Davis & Company, Inc.

13 **SWITCHES** — Catalog 72-D presents a complete line of Type M instruments, control switches and auxiliary switches (indoor and outdoor types), with illustrations and control diagrams. Unit construction, catalog numbers and dimensions, and typical applications are included. Delta-Star Electric Company.

14 **AIR CIRCUIT BREAKERS**—Chart, diagrams, illustrations of applications, detailed information, are contained in a pamphlet, GEA-2997A, on air circuit breakers for protection of resistance-welding machines up to 600 volts, a.c. General Electric Company.

15 **AIR CIRCUIT BREAKERS**—Bulletins GEA 2539B and GEA-1662C give detailed data as to construction, operating currents and tripping characteristics, and dimensions on air circuit breakers (1-pole or multipole, trip free, manually or electrically operated). GEA-2539B covers breakers rated at 250, 600, and 750 volts, d.c., 40,000 amp. interrupted rating; GEA-1662C covers breakers rated at 600 and 750 volts, d.c., 60,000 and 80,000 amp. interrupted rating. General Electric Company.

16 **INDUCTION MOTORS** — Part-by-part description of totally inclosed, fan-cooled induction motors is presented with illustrations in bulletin GEA-1326D. Some typical applications, also illustrated, are included. General Electric Company.

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Factory's Catalog Service (Continued)

17 **PERCENTAGE DIFFERENTIAL RELAYS**—Full details on Type IJD single-pole and triple-pole percentage differential relays for protection of a.c. rotating machines—generators, frequency converters, synchronous condensers, and motors—are given in a new bulletin, GEA-3255. General Electric Company.

18 **"TURBLATOR" OIL CIRCUIT BREAKERS**—Catalog sections 6-e, 6-f, and 6-g give detailed information and diagrams on oil circuit breakers with ampere ranges of 200-3,000 amp., 600-2,000 amp.; and interrupting ratings of 15,000-50,000 KVA, and 100,000-250,000 KVA. Roller-Smith Company.

19 **INSTRUMENT TRANSFORMERS**—12-page booklet describes current transformers for metering installations on networks, through-type current transformer with short-circuiting secondary block, potential transformers for indoor and outdoor use. Westinghouse Electric & Mfg. Company.

20 **FLUORESCENT LIGHTING UNIT**—Illustrated leaflet furnishes information as to features, installation, and maintenance of HF-100 fluorescent lighting unit, the unit package of light. Length, width, height, voltages, net price are given. Hygrade Sylvania Corporation.

21 **LIGHTING FIXTURES**—Comprehensive bulletins, 60 and 61, give detailed information on various types of lighting fixtures for fluorescent lamps. Dimensions, wattage, prices, footcandle curves are included. Wheeler Reflector Co.

22 **FLUORESCENT LIGHTING**—New folder on the fluorescent strip and reflector describes the method of installing fluorescent lighting and presents typical applications and photographs of recent installations. The Wiremold Company.

Fans and Dust Collectors

23 **FANS**—Specifications, prices, dimensions in inches, line drawings showing typical arrangements accompany description of "L" Breezo fans for use with ducts and where it is desirable to install propeller fans so that the fan motor is not in path of the air handled. Buffalo Forge Company.

24 **DUST CONTROL**—Two new folders on the dust problem discuss the costs involved in supporting the "Dust Hog" and "offspring." Illustrations of typical installations are included. Pangborn Corporation.

Instruments

25 **VOLTMETER**—Bulletin 538 sets forth the features of a new portable voltmeter for outdoor survey work. The Bristol Company.

26 **BOILER ROOM INSTRUMENTS**—Booklet 29-31 presents data from which to determine suitable instrument equipment for steam plants out to save fuel. Steam generation and distribution applications for measuring temperature, pressure, flow, liquid level are described and illustrated. The Brown Instrument Co.

Check Coupon on Preceding Page

27 **GRAPHIC INSTRUMENTS**—New catalog, No. 830, gives detailed information on graphic instruments for a.c. and d.c. Ranges and prices for ammeters, voltmeters, single-phase wattmeters, polyphase wattmeters, power-factor meters, milli-voltmeters, 2- and 3-wire wattmeters, and prices and capacities of ammeter shunts and wattmeter shunts are given. Roller-Smith Company.

28 **INSTRUMENTS**—New leaflet illustrates and gives identifying data on such instruments as circuit testers, ohmmeters, precision balances, oil circuit breakers, control and protective relays, rotary switches, control panels, switchboards, air circuit breakers. Roller-Smith Company.

Materials Handling

29 **SHOVEL**—32-page bulletin describes new 2-yd. convertible shovel. Illustrations are used to show its features, structural and mechanical details. Bucyrus-Erie Company.

30 **BALANCER**—Bulletin describes Super Safety Balancer which lifts, suspends, and balances objects weighing up to 200 lb. Illustrations show method of installing the retainer-inclosed spring. Specifications as to sizes, balancing capacity, length of travel, and number of springs are included. Chicago Pneumatic Tool Company.

Power Transmission and Lubrication

31 **POWER DRIVE CLUTCH**—Illustrated leaflet gives details on construction and applications of the D-E automatic centrifugal clutch for power drives. Dawes Equipment, Inc.

32 **MULTIPLE MEASURING VALVE**—Construction and use of the DX multiple measuring valve, for lubricating small machines, or a few bearings on larger machines, are presented in an illustrated folder. The Farval Corp.

33 **SPEED REDUCERS**—Horsepower ratings, torque charts, general dimension and assembly diagrams, and illustrations accompany the detailed description of worm-helical speed reducers—for vertical shaft drives, agitators, mixers—presented in bulletin 75. W. A. Jones Foundry & Machine Company.

34 **GEARS**—7th edition of Book 1574 announces 2 new sizes of P.I.V. gear variable-speed transmission units, vernier control for extra-fine speed variations, table for selection of proper size unit for the service. Illustrations, diagrams, data sheets, and prices are included. Link-Belt Company.

35 **PULLEYS**—Booklet 860, of particular interest to those concerned with plant equipment and its maintenance, contains a complete list of stock sizes and current list prices of a variety of pulleys for special application, and includes information helpful in making a proper choice of pulley. Rockwood Manufacturing Company.

36 **OIL**—Well illustrated brochure describes the refining of industrial oil products; gives recommendations for main power equipment, hauling equipment, metal working, mining equipment, miscellaneous industrial equipment, and miscellaneous petroleum products. Sun Oil Company.

Shop Tools and Supplies

37 **TOOLS**—Line of tool holders; carbon, chrome-vanadium, and detachable-head-socket wrenches; "C" clamps; lathe- and milling-machine dogs; turret-lathe and screw-machine tools; ratchet drills; bits, blades and high-speed steel; setting-up tools; machine-shop specialties; pipe tools; is presented in the new general catalog, No. C-39. Armstrong Bros. Tool Company.

38 **BOLTS, NUTS, SCREWS, RIVETS**—New and enlarged catalog and reference book, No. 39, covers line of bolts, nuts, screws, and rivets; includes list prices, tables, and general information; and is well illustrated. Clark Bros. Bolt Company.

39 **BRONZE BARS**—Reference chart, made to be hung in a convenient place, furnishes size and weight listing of Universal bronze bars for the use of the man in the shop. Johnson Bronze Co.

40 **"UTIL-A-TOOL"**—Bulletin concerning equipment for pushing, pulling, clamping, bending, spreading, hoisting and wheelpulling, contains illustrations showing the tool on the job. List prices are given. Templeton, Kenly & Co.

Steels and Alloys

41 **METAL FOR MACHINE TOOL CASTINGS**—A well illustrated 16-page booklet on "Meehanite"—contains charts of engineering properties and photographs of various applications of "Meehanite" as made by machine tool builders. Meehanite Research Institute of America, Inc.

42 **STEELS**—Reference and general data book contains metallurgical definitions; heat, hardness and numerical-equivalent tables; weight, dimension, and specific gravity tables; carbon-steel, drill-rod, non-ferrous, tubing, sheet, and manufacturing tolerances; standard specifications for reinforcing bars, boiler tubes, plates, bridges, buildings, safe-load tables. Joseph T. Ryerson Son, Inc.

Welding

43 **TORCH BRAZING**—Recent methods of torch brazing Carboloy tools is described in detail with diagrams in a bulletin giving suggestions as to materials required, shank preparation, tip preparation braze assemblies, methods of cooling, designs for inclosed tips, and braze assemblies for special and multi-point tools. Carboloy Company, Inc.

44 **ARC WELDERS**—Recent pamphlet describes d.c. arc welder, 150-amp. size; a.c. arc welder, transformer type, 100- and 200-amp. sizes. General Electric Company.

45 **ARC-WELDING EQUIPMENT**—Comprehensive bulletin, GEA-3042A, presents thyratron-controlled arc-welding equipment for use with bare or lightly coated electrodes. Profitable applications, advantages, the new head, new control, new operator's station, and typical

installations are discussed and illustrated. General Electric Company.

46 **IGNITRON CONTACTORS**—How the ig itron tube operates, dimensions and KVA ratings of the contactors, are the main points covered by bulletin GEA-3058A which describes in detail ignitron contactors for spot and projection welding. General Electric Co.

47 **ARC-WELDING SERVICE**—Bulletin W-26. "The 200-Ampere Multi-Arc Welding Service," describes the new P&H welder, WA-200. Illustrations and cutaway views of the welder; details on its hookup in parallel showing installation in "banks," for multi-arc welding service; information on the multiple-shifter which operates the current-setting indicator in tandem on two or more units when hooked in parallel; and characteristics on single-current control; make this bulletin valuable to users of welding generators. Harnischfeger Corporation.

48 **WELDER** — Detailed information concerning a 200-amp. welder for belt or coupling drive. Illustrations show the welder at work. Data on specifications and optional equipment are included. The Lincoln Electric Company.

Miscellaneous

49 **EXPANSION JOINT** — Essential features of piston-ring expansion joints are presented in a revised 12-page illustrated bulletin. American District Steam Company.

50 **SAFETY EQUIPMENT** — A new catalog, on industrial safety equipment, describes a complete line of eye, head, and lung protective equipment, and safety clothing, for protection from head to ankles. Items included are goggles for protection against impact, glare, splashes of liquids, particles of dust; welding helmets, face shields, and respirators; safety gloves, sleevelets, leggins, aprons, hats, and hoods. American Optical Company.

51 **PENNSYLVANIA**—Profusely illustrated 25-page bulletin points out the industrial advantages of Pennsylvania. Industrial developments; railroad and highway systems; seaports and inland waterways; air transportation; fuel facilities; electric power; metal, food, textile, and process industries; outside purchases; agriculture; raw materials; banking facilities; taxes; are all discussed. Commonwealth of Pennsylvania.

52 **FIRST-AID SUPPLIES**—New catalog on first-aid supplies describes first-aid kits for general and special purposes; dressings, treatments; splints, stretchers, blankets. Davis Emergency Equipment Company.

53 **BASIC REFRACTORIES**—Field of basic refractory service is covered in a new book containing data on processes, application, use and construction of basic refractories. The book is printed in color and has 32 illustrations. The General Refractories Company.

54 **ASSEMBLY EQUIPMENT**—Folder describes standard and hopper-type bins that make up the Binrack assembly units. The Gordon L. Hall Co.

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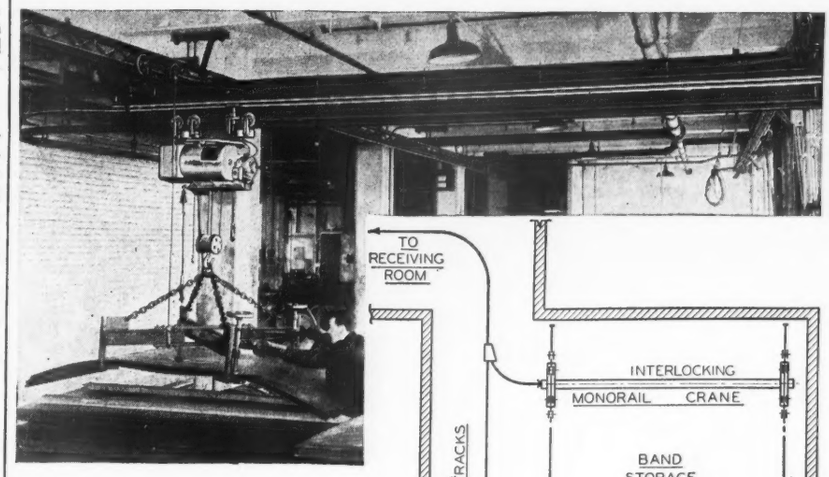
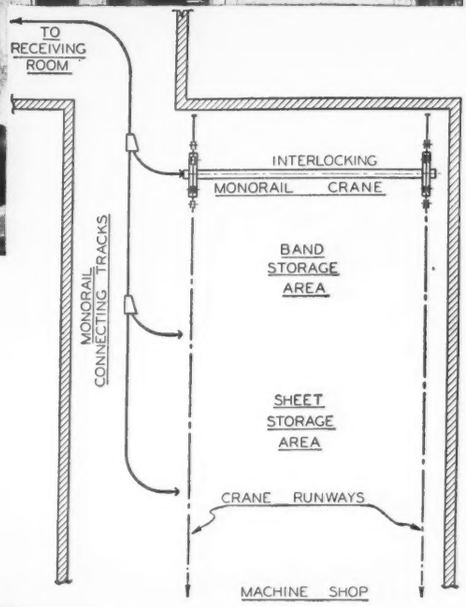
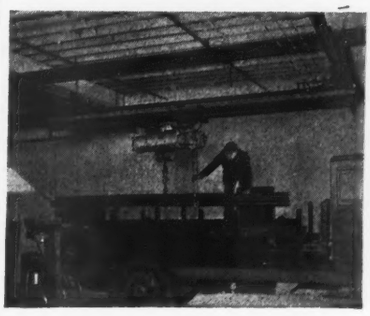
Low-cost Handling System!





Steel moves from receiving dock to storage over this simple American MonoRail system at low handling cost.

Coordinated system assures one-man control of entire stock.



Steel moves safely from truck to stock with no rehandling.

Since no two overhead handling problems are alike, low-cost solutions are found only in a system that offers extreme flexibility of basic design.

American MonoRail equipment meets varying requirements at low initial cost because standard parts of such flexible design are fabricated into special units and coordinated into systems guaranteed to produce the results intended.

For either manual, electric or automatic operation these systems invariably overcome operating congestion, eliminate costly maintenance and reduce handling expense wherever applied. Engineering consultation is available without obligation.

A 254 page book used as a technical reference for all data covering Mono-Rail Equipment will be sent on letterhead request.

AMERICAN MONORAIL CO.

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SUPER VISIBLE

The only major development in Visible Record Systems Equipment in 15 years!

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Greatest Visible Card Capacity.

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Housing Arrangements for Every Record Requirement.

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No Matter how large or how small record requirements are Super-Visible can ideally meet them.

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NOW! Visible Records can be installed as fast or faster and more economically than conventional "blind" card systems.

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After that you have the valuable benefits of Super-Visible Records and Business Controls.

Write or wire for complete information and prices on Acme Super-Visible Card Record Systems.

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VISIBLE RECORD SYSTEMS EXCLUSIVELY SINCE 1914

Modernize your **PLANT VENTILATION**

FOR Greater SAFETY Efficiency Better LABOR Relations

Efficient ventilation becomes highly important, as cool weather requires closing of factory doors and windows. To keep your men alert, maintain and increase production efficiency, provide a constant flow of fresh air. Allen Ventilators do this postively, and at low cost!

"Fresh Air is FREE with Allens"

Install Allen Coni-Vane Turbine Ventilators on your plant according to scientifically engineered plan, and the ventilation job is permanently solved—automatically done day and night. There is an ALLEN Ventilator to suit every industrial job. Let our engineering department consult with you on this vitally important matter. Conference and plans without obligation. The graceful, symmetrical lines and pleasing appearance of Allen Turbine Ventilators modernize old buildings or harmonize with the modernistic trend of new plants.

Allen Ventilators,—the original turbine ventilators,—have been built for more than twenty years and used throughout the world on leading factories, auditoriums, ships and shops. They are made of finest materials, expertly engineered, and have the reputation of outlasting the building on which they are installed. For high utility and long life, use ALLEN Turbine Ventilators.

We have a representative near you—he will consult with you at your convenience without obligation. Write for literature.

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9763 Erwin Ave., Detroit, Michigan, USA

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YOU'RE LOOKING AT A WING CHANNEL FENCE POST!

PAGE pioneered in originating and designing this post especially for chain link fence fabric. It provides even greater strength and utility. This post, a PAGE contribution to better protection, is only one of many exclusive advantages. 56 years of fence service is available through one of our 92 Association Members—a locally responsible firm interested in serving you. Secure his name and free literature—write PAGE FENCE ASSOCIATION, Bridgeport, Conn.

How This New Fluorescent Lighting Improves Inspection & Precision Operations

Objects and defects invisible to the average eye under poor light become easily visible when the proper light is provided. Thus good light makes it easy to see fine details and to improve the *quality of production.*

An increase in illumination from one foot-candle to twenty foot-candles triples the speed of seeing. The time thus saved can be used to increase the *quantity and quality of production* instead of being wasted in trying to see!

Such facts as these have been scientifically established in the laboratories and performance proven in thousands of plants. They demonstrate the importance of more light and better quality of lighting as now provided by the new Benjamin Fluorescent Lighting Units.

Cold Light Without Annoying Glare

With Benjamin Fluorescent lighting you can provide employees with extra light of soft and diffused quality that will greatly increase their ability to see quicker, better, easier and with less fatigue.

Light generated by the new Mazda Fluorescent lamps is COLD LIGHT. Benjamin lighting units therefore can be mounted as close to the work as necessary without subjecting the worker to annoying heat radiation. Because of the low brightness of these lamps and the cut-off of the reflector annoying glare is minimized.

Lower Cost Daylight Lighting

As Fluorescent lamps are available with different color qualities, it is possible to fit Fluorescent lighting to the seeing tasks found in plant, laboratory, drafting room and office. For example, for operations involving color, a light of very good daylight quality can be secured with the use of the *Daylight* Fluorescent Lamp. This daylight quality is obtained without the heavy light loss entailed by the filters required to produce light of similar daylight quality with the ordinary incandescent lamp.

Cold light without annoying glare provided by Benjamin units helps your mechanics, operators, inspectors and others to see better, faster and more accurately.

Warranty of Performance and Construction

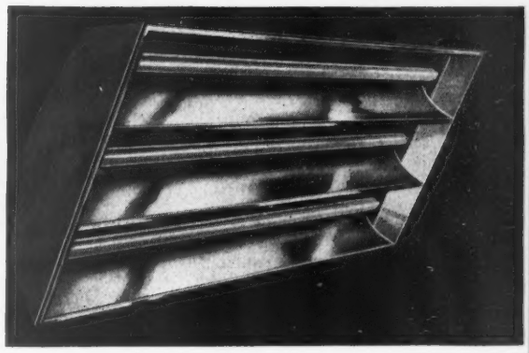
All Benjamin Fluorescent units are designed to give the highest light output efficiency and are warranted by Benjamin to comply with all recognized safety requirements, electrical, illumination and mechanical standards. They are certified to meet with the requirements of the Underwriters Laboratories as evidenced by their inspection label affixed to each unit.

Free Data and Demonstration Service

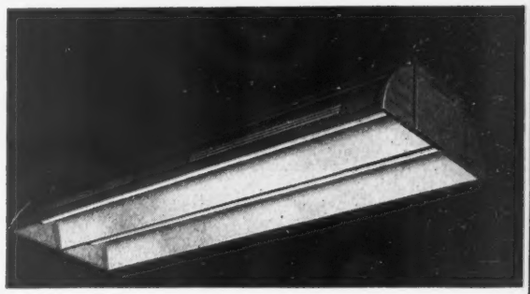
If you have a lighting problem in your plant and wish data and demonstrations of the improved lighting which can be secured with these Benjamin units, call in a Benjamin Lighting Specialist. By training and experience, he is an expert in industrial lighting and his services are available to you upon request without cost or obligation.

Send for New Bulletin

Complete information on these Benjamin Fluorescent Units is contained in a new Bulletin, Number 600, and in other data sheets to be published from time to time. Your return of the coupon below will bring you the Bulletin and place your name on our list of those to receive future publications. Benjamin Electric Mfg. Co., Des Plaines, Illinois.



BENJAMIN DAYLITER—a three lamp unit for the 36″ Fluorescent Lamp. Reflecting surfaces are of efficient Alzak aluminum; housing of durable porcelain enamel. Furnished complete with auxiliaries.



New BENJAMIN FLUR-O-LITER—an entirely new unit available after November 1, 1939, for the new 48″ white and daylight fluorescent lamps. All steel housing eliminates dust and dirt. Alzak Aluminum Reflector of high efficiency. New type auxiliary provides high power factor and minimizes flicker.

MAIL COUPON for new BULLETIN No. 600

BENJAMIN

LIGHTING EQUIPMENT

Distributed Exclusively Through Electrical Wholesalers

BENJAMIN ELECTRIC MFG. CO., Des Plaines, Illinois.

Gentlemen:

We are interested in data to show how our lighting may be improved. Please send us your Bulletin No. 600 and place my name on your mailing list for all future publications on Benjamin Fluorescent Units.

Name.....

Title.....

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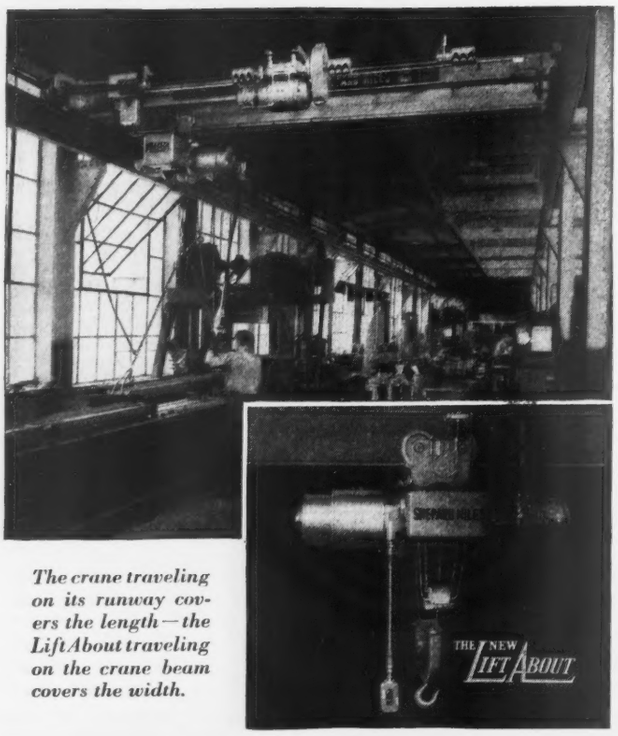
For your LIGHT LOADS!



The crane traveling on its runway covers the length—the Lift About traveling on the crane beam covers the width.

● Shepard Niles single I-Beam Cranes are widely used in practically every industry for loads up to five tons capacity.

This single I-Beam Crane combined with the new Shepard Niles Lift-About will cover every square foot of the bay with vertical lifts, eliminating all side pulling and dragging of loads.

A COMPLETE LINE OF CRANES AND HOISTS

SHEPARD NILES CRANE & HOIST CORP.

364 Schuyler Avenue, MONTOUR FALLS, N. Y.

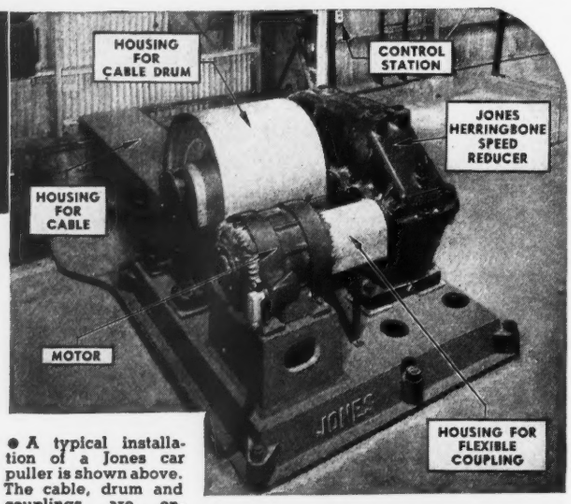
For spotting your cars- JONES CAR PULLERS

YOU will be surprised how much time can be saved in the spotting and switching of cars by using a Jones car puller. These sturdy, compact units will speed up car handling to the point where they soon pay for themselves in the saving of time and labor.

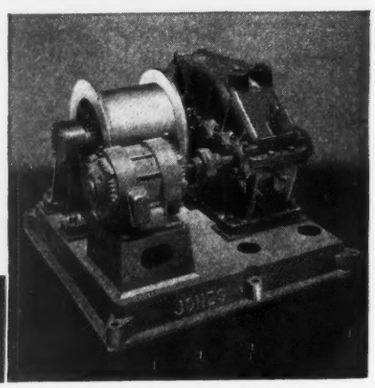
These car pullers are built by Jones as complete units with motor included if desired, or with base to take standard motor, as supplied by the purchaser. The cable drum is driven by a Jones triple reduction Herringbone speed reducer and the control station may be located at a point to give the operator a clear view of the tracks and spotting positions.

Even in plants where comparatively few cars are handled it has been found that a Jones car puller more than pays its way. Prices and complete information will enable you to judge whether such an outfit might pay out in your plant. Write for complete information.

W. A. JONES FOUNDRY & MACHINE CO.
4433 Roosevelt Road, Chicago, Illinois



● A typical installation of a Jones car puller is shown above. The cable, drum and couplings are enclosed by sheet metal housings as an extra precaution in this installation to eliminate all hazard from moving parts.



● A complete Jones car puller unit. These outfits are for use with wire rope and are manufactured in a wide range of capacities to suit the number of cars to be handled in each plant.

Jones

HERRINGBONE—WORM—SPUR—GEAR SPEED REDUCERS
CUT AND MOLDED TOOTH GEARS • V BELT SHEAVES
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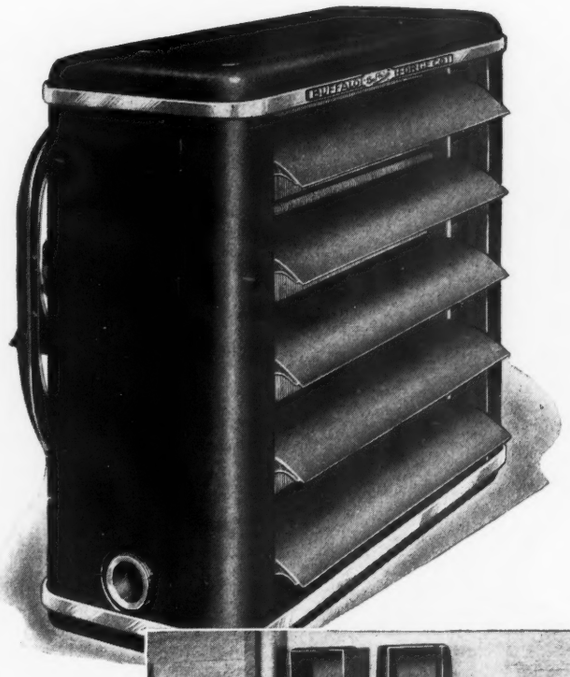

There are unit heaters and unit heaters, just as there are shoes and shoes. If you want the best in comfort, service, and appearance, you ask for shoes made by a manufacturer who has built a reputation over the years for such qualities.

And factory men who want the best in heating comfort, years and years of quiet, trouble-free operation at minimum cost, and fine appearance send their Unit Heater orders to the Buffalo Forge Company.

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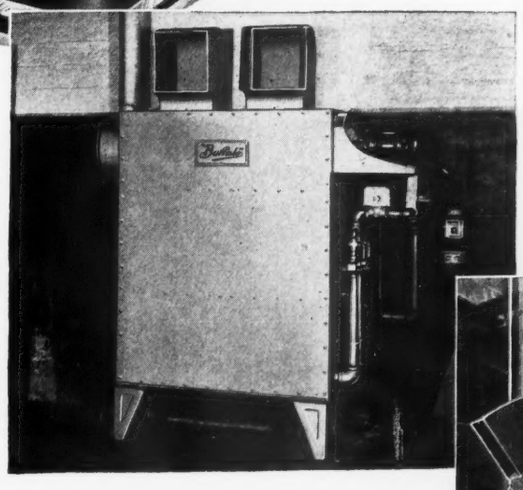

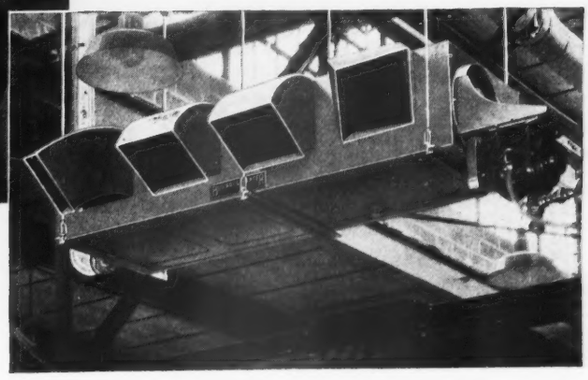

Use suspended or floor type units or flat suspended type as shown at right, gas or steam models.

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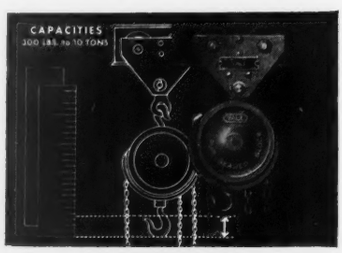
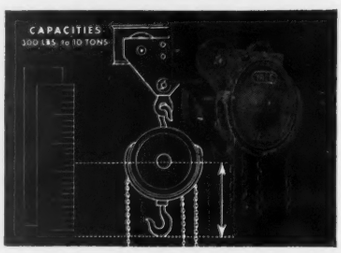
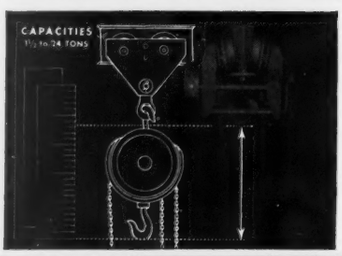
For headroom saving of minor proportions, the Clevis Type Hoist is suggested. This hoist saves from 3 to 16 inches depending on the capacity involved. Should this prove inadequate, the Trolley Type Hoist should next claim your attention. This will save from 8¾″ to 2′ 3″ according to capacity. In the event that a still greater saving is required, Yale has developed a hoist that will settle practically all headroom problems—the Rail Hugger. **Providing the shortest headroom available in any hand hoist,** it will save from 18″ to 5′ 1″ depending on capacity. It's Headroom Saver No. 1!







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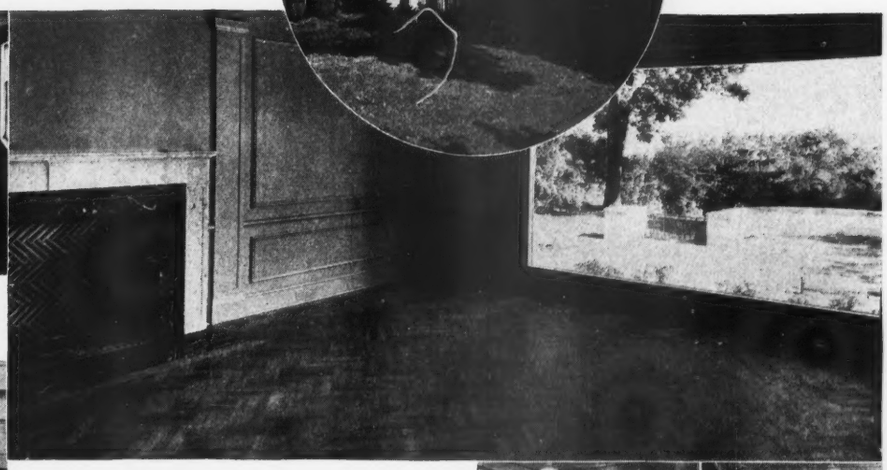
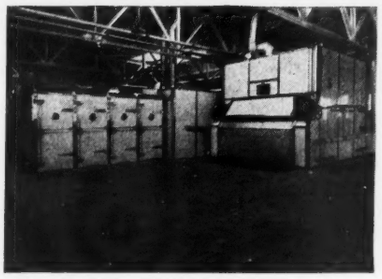
Service counted *with Oak Park, Chicago suburb. The new "gym" added to its Emerson school, was floored with Hard Maple, which "had served so well in the original building."*



School's a happier place *for children confined, when floors are warm and dry and cheerfully clean, as in this Indianapolis classroom, one of thousands floored with Hard Maple.*

5 years outdoors *in rain, sun and snow, yet this dance floor at Chicago's White City remains in good condition. Perfect for dancing, smooth Hard Maple lowers operators' costs as well.*



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Of all floorings, this pays dividends, every year of its life . . . dividends not only in comfort, in pride of ownership and satisfaction in use, but in *"low cost of using."* For its smoothness is lasting, its beauty practically permanent, its cost of maintenance and cleaning remarkably low. And, usually, its extra years of service make it the most economical flooring that money can buy.

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Hundreds of skaters nightly rolling on eight wheels *each—that's punishment. But "Skateland" with its log cabin style* **MFMA** *Maple floor (Trenton N. J.) makes sure of satisfied skaters, as rinks everywhere.*

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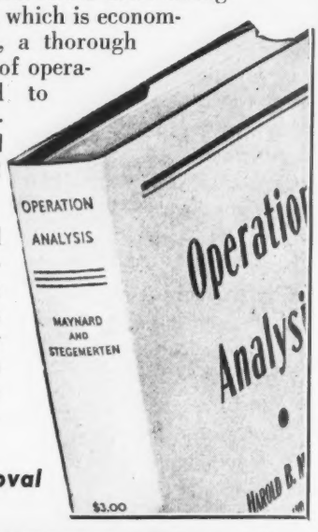

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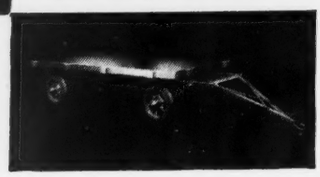

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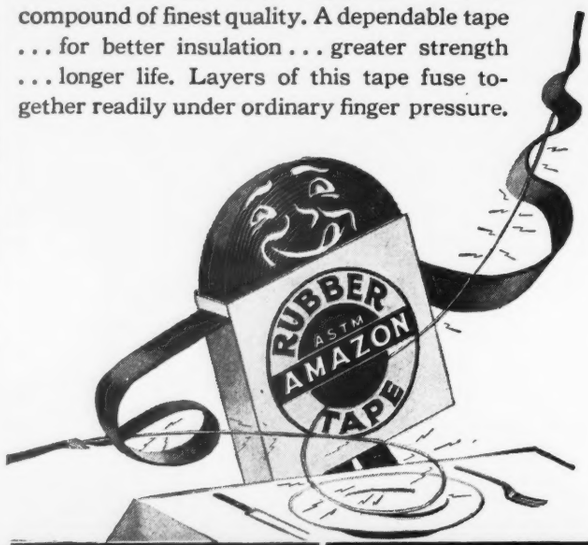

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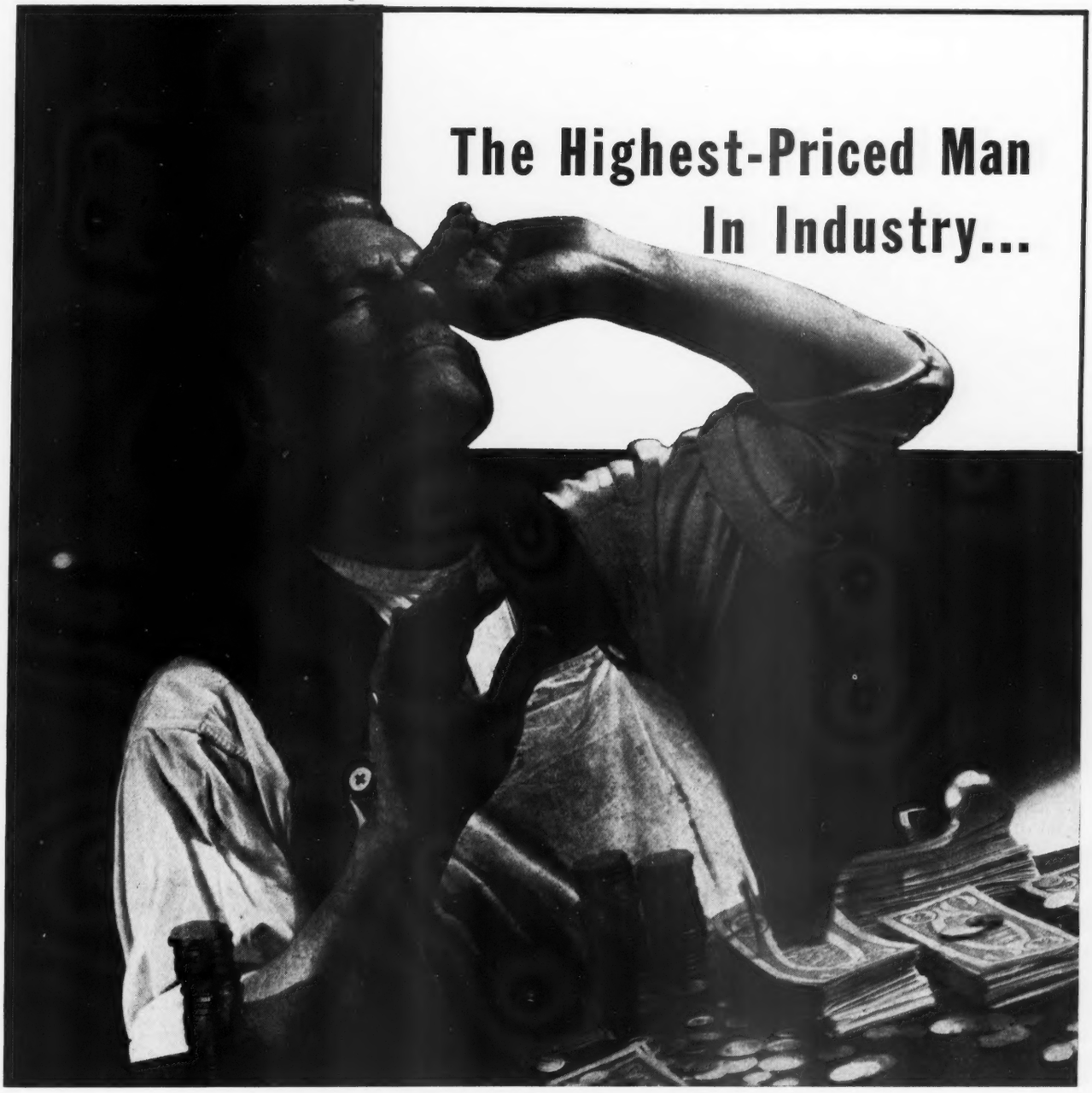

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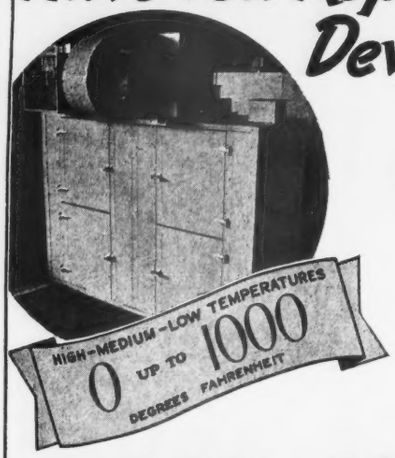

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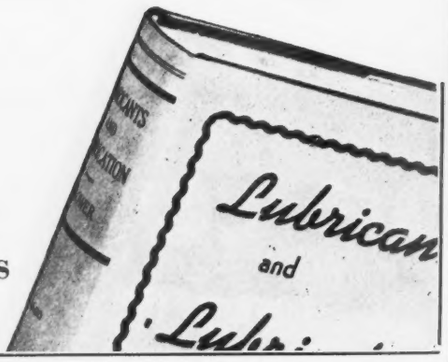

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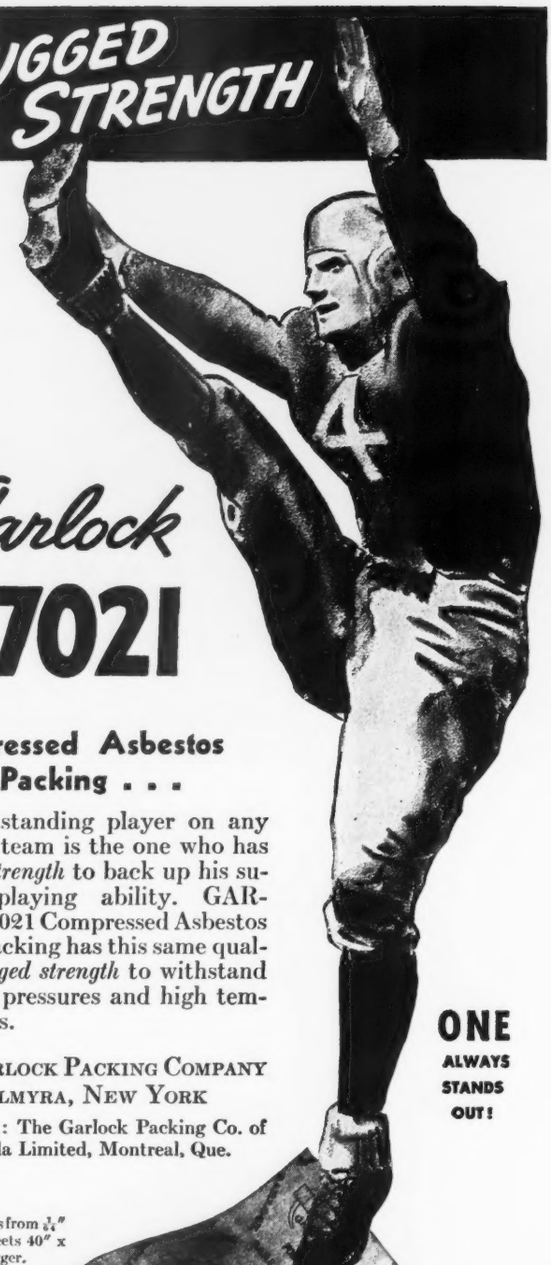

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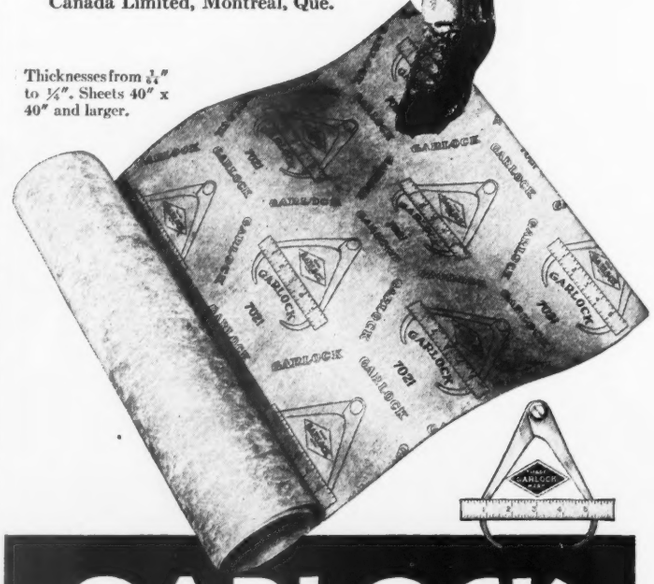

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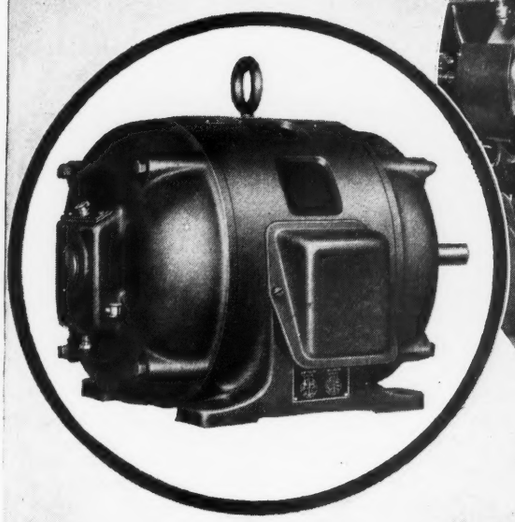

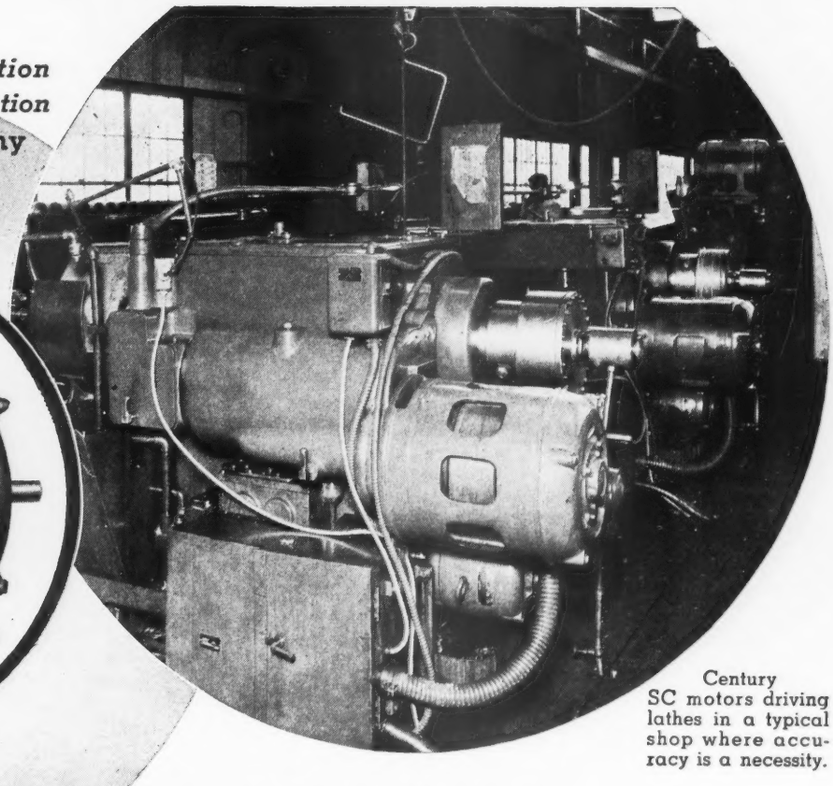

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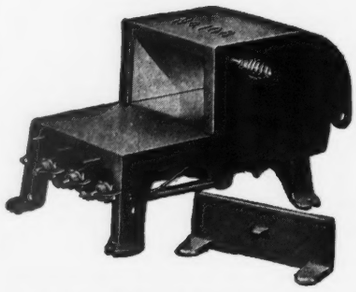

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Jry GRAPHITE

Miss no chances to cut lubrication costs, improve lubrication. Try Dixon's Natural Flake Graphite — time-tested product of proved excellence for applications where high temperatures, pressures, and speeds are encountered.

No mere "fillers", Dixon's Flake Graphite is a lubricant in itself—inert and insoluble in all commercial liquids, even at highest temperatures.

DIXON'S TICONDEROGA FLAKE LUBRICATING GRAPHITE, in two flake sizes, stands up where other lubricants fail. Also invaluable for coating gaskets and packing, miscellaneous uses.

DIXON'S MICROFYNE POWDERED GRAPHITE is especially valuable as a stabilizing agent mixed with oils or greases. Also widely used as a dry lubricant for small parts with small clearances.

Ask your dealer today—or write Dept. C-44.

JOSEPH DIXON CRUCIBLE CO.
JERSEY CITY NEW JERSEY
DIXON'S GRAPHITE PRODUCTIONS

Here's where

SCREW COSTS *mount up*

. . . and where PHILLIPS screws

CUT THEM DOWN

AVERAGE 50% LESS ASSEMBLY TIME

The patented Phillips recessed head means that *every screw is used*. Phillips Screws cling to the driver—none fumbled, even with one hand steadying the work. Phillips Screws are self-centering—none driven crooked. Phillips Screws fit the driver snugly—no reaming action to throw up burrs.

Shape, taper and depth of the genuine Phillips recess were determined after thousands of tests. The recess utilizes the driver's maximum turning power without sacrifice of strength in the screw head . . . without danger of shearing the metal.

So, give your assemblies the benefit of this fastening method that so many thousands of manufacturers have adopted. And give yourself the benefit of profits that Phillips Screws will earn on your production line.

Write for facts about further advantages—elimination of spoilage, tighter assemblies, improved appearance, etc. Address one of the firms listed below.

This Booklet will help your plant to cut fastening costs and improve assemblies. Address one of the firms below for free copy.

The rubbish barrel takes care of any savings a manufacturer thinks he is making by buying *slotted* screws instead of *Phillips* Recessed Head Screws.

Screws dropped on the floor . . . screws that drive crookedly and get their threads spoiled . . . screws that burr easily or split at the head . . . *these* are the *expensive* screws. You save *their* cost by buying Phillips.

YOU WOULDN'T PLAY EVERY SHOT WITH ONE DRIVER

For efficient driving, contact between recess and driver should extend as far as possible from the screw's axis. On the other hand, too big a driver means stripping threads or tearing fibre structure of wood or metal. Thus it requires four driver sizes to drive properly the entire range of recessed head screws. Two sizes of Phillips Drivers handle diameters No. 5 through No. 16 or approximately 85% of all screws driven.

PHILLIPS *recessed head screws*

MACHINE SCREWS · SHEET METAL SCREWS · WOOD SCREWS · STOVE BOLTS

U. S. Patents on Product and Methods Nos. 2,046,848; 2,046,837; 2,046,839; 2,046,840; 2,062,065; 2,084,078; 2,084,079; 2,090,338. Other Domestic and Foreign Patents Allowed and Pending.

American Screw Co., Licensor, Providence, R. I.
Chandler Products Company, Euclid, Ohio
Continental Screw Co., New Bedford, Mass.
Corbin Screw Corporation, New Britain, Conn.
The Lamson & Sessions Co., Cleveland, Ohio
National Screw & Mfg. Co., Cleveland, Ohio
Parker-Kalon Corporation, New York, N. Y.
Pheoll Manufacturing Company, Chicago, Illinois
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Scovill Manufacturing Co., Waterbury, Conn.
Shakeproof Lock Washer Co., Chicago, Ill.

IT COSTS LESS TO USE PHILLIPS SCREWS

FOR

Extra Long Hauls

choose the

CAB CONTROLLED

A-E-CO LO-HED HOIST

***When*—1.** Hauls are exceptionally long. 2. Many bays must be served. 3. The path under hoist is obstructed. 4. Speed is essential.

The motor trolley, cab controlled A-E-CO Lo-Hed Hoist—motor trolley with cab trailer—is the best to use.

For high-lights of this hoist see A-E-CO POINTS (below). For full details of Lo-Hed hoists, send for our new catalog today.

A-E-CO POINTS

- Lo-Heds range from ¼ to 12 ton capacities (above type available from 1 to 12 tons).
- Operates on Standard I-beam or track of any make.
- Low headroom—stacks materials higher than any other hoist.
- Safe, fool-proof.
- Compact, strong, simply constructed.
- Protected against dust, moisture, fumes.
- Heavy duty, ball-bearing HOIST SERVICE motors.
- Automatic lowering brake.
- Ball or roller bearings at vital points.
- Improved plow-steel cable.
- 100% positive automatic stop.
- Indoor (open) and Outdoor (glazed) cabs.
- Efficient spur-gear drive . . . and

LO-HED COSTS LESS PER LIFT

AMERICAN ENGINEERING COMPANY

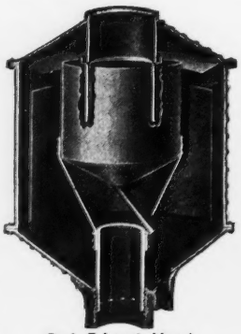
A-E-CO Lo-Hed HOISTS

2426 ARAMINGO AVENUE, PHILADELPHIA, PA.

OTHER A-E-CO PRODUCTS: TAYLOR STOKERS
MARINE DECK AUXILIARIES • HELE-SHAW FLUID POWER

BURT

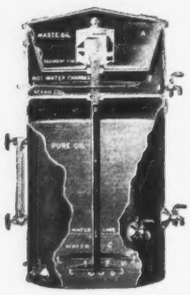
Exhaust Heads Save Money Many Ways



Burt Exhaust Head

Definite economies result from installing Burt Exhaust Heads. They eliminate condensation and oils from exhaust steam without producing back pressure—protect roofs . . . keep walks below ice-free . . . recover feed water . . . reduce noise. Scientific design eliminates baffles in steam chamber. Sturdily built. The standard of efficiency for 25 years. Two types, any size, Burt or Standard. Write for catalog.

BURT Oil Filters



American Type

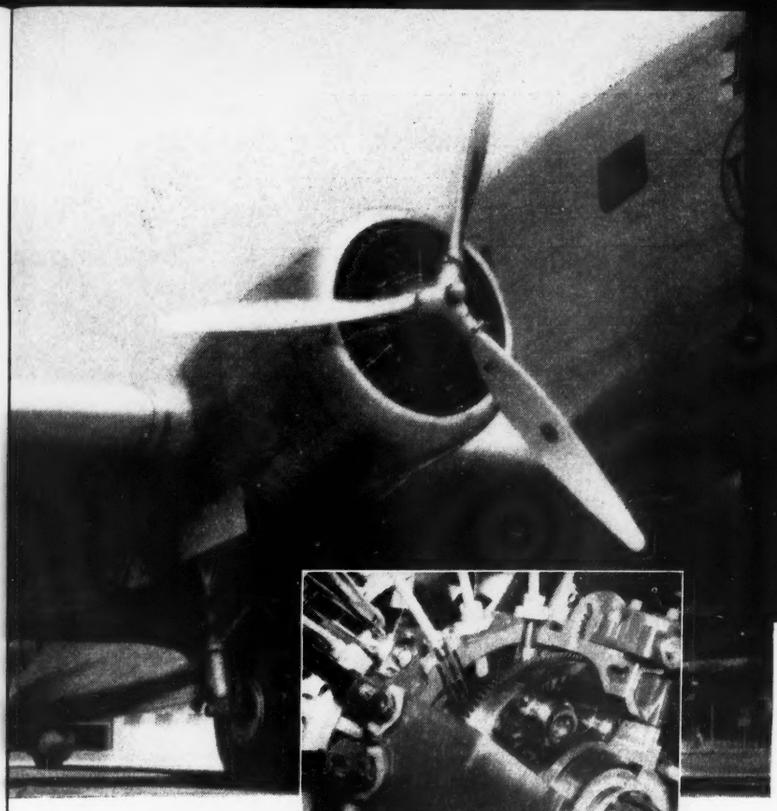
Cut Costs 50%

Recover used oil, filter it, and you have practically new oil, without loss of lubricating quality. Safe and reliable. Used in leading power plants everywhere. Types and sizes for all conditions.

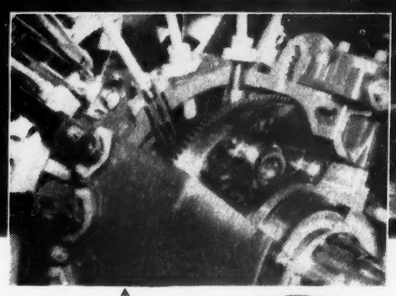
The Burt Mfg. Co.

955 So. High St., Akron, Ohio

Write for catalogs of Oil Filters, Exhaust Heads and Roof Ventilators.



WRIGHT CYCLONES
Use Planetary-gear System for Dependability and Compactness



Planetary-gear system used in Wright Cyclone aircraft engines

Planetary-gear system used in General Electric gear-motors

Typical G-E gear-motor

You Get the Same Advantages in G-E Gear-Motors

LIGHT WEIGHT, compactness, simplicity are extremely important in all phases of aircraft engine design. The Wright Aeronautical Corporation has solved the problem of obtaining the desirable light weight, compactness and efficiency in the reduction gearing of Cyclone propeller shafts by using a planetary gear system.

By using G-E gear-motors for low-speed drives, industry, too, can obtain the very desirable feature of compactness, with that high degree of reliability so essential in modern airplane drive, since G-E gear-motors use the same type of planetary system in their gear-reduction units as is used in the propeller drives of modern airplane engines.

No matter what type of low-speed drive you may need for your conveyors, pumps, mixers, or other low-speed machines, a G-E gear-motor is the correct solution. General Electric gear-motors are available in ratings from 1/8 to 75 hp, with output speeds from 6 to 600 rpm, in polyphase, single-phase, or direct-current types—a type of modification to fill every low-speed drive purpose.

Investigate the many advantages obtainable by the use of G-E gear-motors for your low-speed drives. For further information, call the nearest G-E office or write General Electric, Schenectady, New York.

GENERAL ELECTRIC

020-389

5 STEPS in PRACTICAL Industrial Relations

Well-intentioned "good-will" programs often fail because workers don't *understand* them. How much easier and more effective to start with things in the plant or office closer to their everyday life!

Already successfully used by others, the following practical suggestions may be valuable to you. They are the kind of personal, workday things that may bring a warm response from your people —that encourage a man to say "I've got a good job with a good company!"

1 Men working under high temperatures get quick relief from fatigue and heat cramps by eating 4 to 6 sodium chloride tablets a day. A handy dispenser near each water cooler does the trick.

2 "Good Housekeeping" in plants: Cleaning oil and grease from floors, removing dust from fixtures and beams, checking light bulbs, and painting walls brighten spirits and improve efficiency.

3 Many plants have successfully organized Employee Safety Committees among workers to make safety recommendations for their departments. Such sharing of responsibility creates mutual respect and good will.

4 Plant and office improvements should be carefully interpreted to employees by letters, bulletins or talks. By thus taking them into your confidence, you build solidly for increased co-operation.

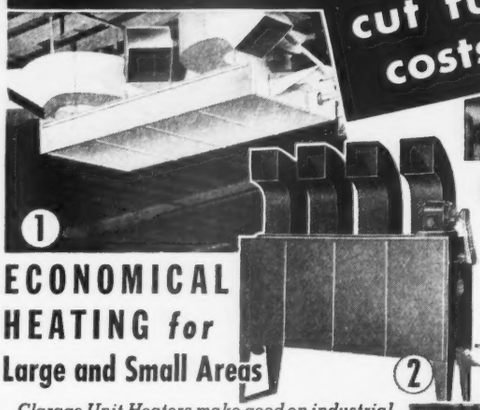
5 Adequate, sanitary washrooms with plenty of basins, hot water, soap and fresh individual ScotTissue Towels remind workers daily of your interest in their comfort and well-being.

HAVE YOUR WASHROOMS SURVEYED

The Scott Washroom Advisory Service is available to help arrange washrooms comfortably, economically and efficiently. This free service will suggest how to relieve congestion, reduce waste and overhead expense in plant and office washrooms, and help create good will. A Scott Washroom Survey will be made of your washrooms without obligation. Please write: Scott Paper Company, Chester, Pa.

Copr., 1939, Scott Paper Co.
Trade-Mark "ScotTissue" Reg. U. S. Pat. Off.

CLARAGE Unit Heaters cut fuel costs



ECONOMICAL HEATING for Large and Small Areas

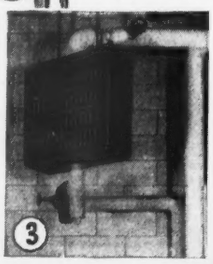
Clarage Unit Heaters make good on industrial jobs—in factories, mills, warehouses, etc. . . . also widely used in garages, stores and offices.

1. *Suspended Unitherm Unit,* scientifically designed for heating large spaces. Equipped with high-velocity, centrifugal fans insuring uniform diffusion and rapid heating pick-up. Square outlets adjustable four ways.

2. *Floor Mounted Unitherm Unit,* another large area heater of similar design. Both types of Unitherms can be furnished with CLARAGE Syncrotherm Control which guarantees even greater fuel savings.

3. *Suspended Clarco Unit,* ideal for heating small spaces, or where more heat is needed than present equipment can supply.

Immediate Delivery can be made on practically any size in either type. *Write us today for literature.*



Unsurpassed Performance

Shrewd buyers come back to us time and again for more of these highly-efficient, dependable heating units. One automobile company has reordered nineteen times—a steel company eight times—a paper mill six times, and so on.

To make SURE of trouble-free service, we balance the fan wheels BOTH statically and dynamically; use larger shafts; provide a bent-tube safety coil.

If you're after REAL ECONOMY, try CLARAGE the next time you have a heating problem, no matter how large or how small.

COMPLETE AIR CONDITIONING
COOLING
VENTILATION
FACTORY HEATING
MECHANICAL DRAFT
FANS and BLOWERS for INDUSTRIAL NEEDS

CLARAGE FAN COMPANY—KALAMAZOO, MICH.
SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES

SAVE the HANDS That Make Your PRODUCTS!

Factory hands are hard to clean at best, but good management sees to it that hand cleaners are safe as well as effective. Harsh, powerful or highly abrasive cleaners are hard on workers' hands and often lead to infections.

MAGNUS HAND CLEANER

is a powdered, water-free, economical material requiring no harsh rubbing or scrubbing. Works as well with cold water as hot. It is sanitary and keeps hands in good condition. A little goes a long way, even on the toughest of hand cleaning jobs.

Made in three grades: Heavy duty for mechanics and extra dirty hands; Mild, for general use and Superfine for office workers or those with tender skins.

TRY MAGNUS HAND CLEANER

Order a trial case of 10 oz. cans. Use them in place of your regular cleaner for a month. If you and your workers are not completely satisfied, send the unused portion back to us for complete credit on the entire case. And remember — there's a handy economy-inducing Magnus Hand Cleaner dispenser for wash room wall.

MAGNUS CHEMICAL COMPANY

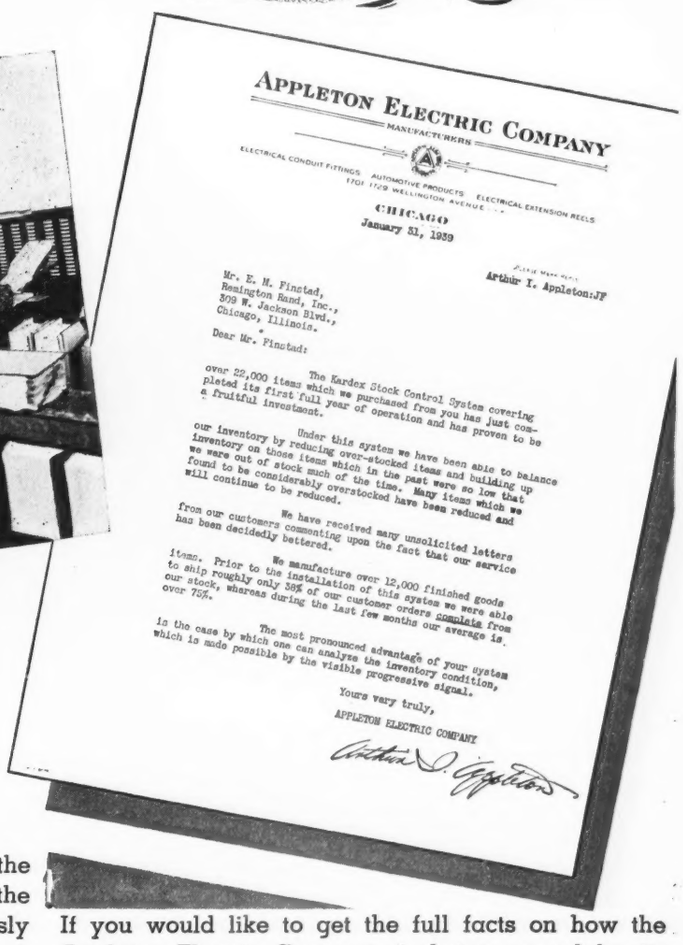
Manufacturers of Cleaning Materials, Industrial Soaps, Metallic Soaps, Sulfonated Oils, Emulsifying Agents and Metal Working Lubricants

220 South Avenue — Garwood, N. J.

Magnus CLEANERS

$15,000.00 A YEAR IN NEW PROFITS

BY ELIMINATING "LAZY DOLLARS"



APPLETON ELECTRIC COMPANY
MANUFACTURERS
ELECTRICAL CONDUIT FITTINGS AUTOMOTIVE PRODUCTS ELECTRICAL EXTENSION REELS
1701 17-29 WELLINGTON AVENUE
CHICAGO
January 31, 1939

Arthur I. Appleton:JF

Mr. E. H. Finstad,
Remington Rand, Inc.,
309 W. Jackson Blvd.,
Chicago, Illinois.

Dear Mr. Finstad:

The Kardex Stock Control System covering over 22,000 items which we purchased from you has just completed its first full year of operation and has proven to be a fruitful investment.

Under this system we have been able to balance our inventory by reducing over-stocked items and building up inventory on those items which in the past were so low that we were out of stock much of the time. Many items which we found to be considerably overstocked have been reduced and will continue to be reduced.

We have received many unsolicited letters from our customers commenting upon the fact that our service has been decidedly bettered.

We manufacture over 12,000 finished goods items. Prior to the installation of this system we were able to ship roughly only 38% of our customer orders complete from our stock, whereas during the last few months our average is over 75%.

The most pronounced advantage of your system is the case by which one can analyze the inventory condition, which is made possible by the visible progressive signal.

Yours very truly,
APPLETON ELECTRIC COMPANY

Arthur I. Appleton

SEE HOW THE APPLETON ELECTRIC CO. HAS STEPPED UP INVENTORY TURNOVER; REDUCED UNDERSTOCK AND OVERSTOCK WITH KARDEX STOCK CONTROL SYSTEM

Imagine, $15,000 annually in *new* profits from the same volume of business simply by eliminating the "lazy dollars" that were unknowingly and needlessly upping the cost of "owning" an inventory. *Any business* can reduce inventory carrying charges, storage costs, obsolescence write-offs, out-of-stock "lost" orders, production delays, needless taxes, frozen capital ills and kindred *hidden* costs that are spotlighted daily by Kardex Stock Control Systems.

If you would like to get the full facts on how the Appleton Electric Company is being served by its Kardex Stock Control Record simply mail the coupon. We'll send you a free copy of our new booklet which completely details the operation and benefits of Kardex Stock Control in eliminating "lazy dollars" for *new* profits. There is no obligation.

Remington Rand Inc.
Buffalo New York

MAIL THIS COUPON FOR THE CONVINCING FACTS!
Remington Rand Inc.,
465 Washington St., Buffalo, N. Y.
Indeed, you may send me your new book, "Get Those Profit Stealing Lazy Dollars Out Of Your Inventory." No obligation, of course!
Signed .....
Firm .....
St. & No. .....
City & State .....

DUST HOGS have babies!

• *One* dust problem *uncontrolled* . . . soon becomes ONE-TWO-THREE-FOUR-FIVE DUST PROBLEMS!

• The sooner you CONTROL your first Dust Nuisance, the sooner you save the multiplying losses uncontrolled Dust brings. Let experienced Pangborn Engineers discuss this riddance with you. No obligation, write to Pangborn Corporation today.

PANGBORN

THE WORLD'S LARGEST MANUFACTURER OF DUST CONTROL AND BLAST CLEANING EQUIPMENT

PANGBORN CORPORATION · HAGERSTOWN, MD.

Employees Work Better with FOOD!

Ideal FOOD CONVEYORS bring it to them on the job!

Both employers and employees benefit when Ideal Food Conveyors provide periodic food distribution throughout the factory. Model No. C-877-C shown above has serving deck and drop shelf of stainless steel . . . plate glass display section . . . glass wool insulation. Refrigeration compartment. Heated compartment. Write for free copy of interesting booklet, "Human Beings at Work."

THE SWARTZBAUGH MFG. CO.

ESTABLISHED 1884 TOLEDO, OHIO

Associate Distributors—The Colson Corp., Elyria, Ohio. The Colson Equipment & Supply Co., Los Angeles, San Francisco; The Canadian Fairbanks-Morse Co., Canada.

JOYCE HYDRAULIC *Materialift*

HOW, WHY and WHERE to use it

Get New Catalog 600

• Here's a new 12-page Book of Facts that every Factory Manager should have. It shows in pictures and specifications seven different types of JOYCE Materialifts, adapted to every lifting problem from automatic feed tables to pilot houses which must be lowered for bridge clearance. It will give you many time, space and money-saving suggestions. Send coupon today.

THE JOYCE-CRIDLAND CO. • DAYTON, OHIO

Send Free Catalog

Name .....

Firm .....

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READY! Industry's first complete FLUORESCENT DAYLIGHT UNIT

Modernize your plant!

A COMPLETE LIGHTING UNIT—A LIGHTING MIRACLE—AMAZINGLY EFFICIENT—GIVES SEVERAL TIMES THE LIGHT—ENDS HARSH SHADOWS—CUTS HEAT ONE-HALF—NO COSTLY RE-WIRING!

JUST HANG IT UP— AND PLUG IT IN—

HF-100

FLOODS OF DAYLIGHT

Amazingly efficient—produces floods of cool controlled daylight at moderate cost. Comes complete with 2 *standard* HYGRADE 40 Watt, T-12 Fluorescent Lamps all ready to hang up and plug in.

NO picture or description can do justice to the amazing efficiency of this miraculous new light. Our complete lighting unit, engineered and designed particularly for industrial use. Corrected for power factor and stroboscopic effect. Simply hang it up and plug it in any 60 cycle AC circuit. Overall wattage of unit is approximately 100 watts.

Ideal for obtaining high levels of general illumination efficiently and economically. Rugged construction of unit and long life of lamps insures low maintenance cost.

If you are interested in lighting economy—in increased production—decreased spoilage—fewer accidents—get in touch with your local HYGRADE jobber, or use the coupon for more facts about HYGRADE Fluorescent.

CLIP TODAY!

Hygrade Sylvania Corporation
Salem, Mass.
I am interested in Hygrade Fluorescent Lighting Unit HF-100.
I want prices, discounts, full information.

Company_____
Individual_____
Address_____
City and State_____

LOW COST — Hygrade — FULL LIFE — MORE LIGHT

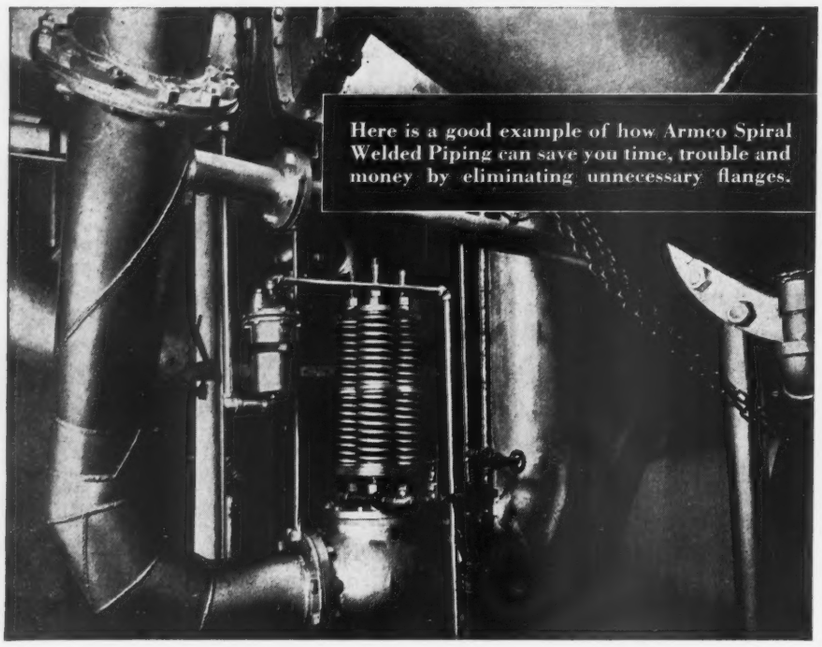
Hygrade *Fluorescent* Lamps

Hygrade Sylvania Corporation Est. 1901

MAKERS OF SYLVANIA RADIO TUBES AND HYGRADE INCANDESCENT LAMPS

Copr. 193 Hygrade Sylvania Corp.

STREAMLINE YOUR PIPELINE ..SAVE TIME AND MONEY


Here is a good example of how Armco Spiral Welded Piping can save you time, trouble and money by eliminating unnecessary flanges.

Note the neat, trim pipe lines in this picture. Unnecessary joints have been eliminated by designing with Armco Spiral Welded Pipe. More than just nice appearance, this means actual saving of time and money. Here's the story . . .

Armco Pipe and fittings are shop-fabricated to your exact specifications. By ordering Armco fittings attached to straight pipe runs, you save two flanges on each bend, avoid excess weight, and lessen the chance of joint leakage. Installation is simplified too. Armco Pipe goes in fast without costly delays. There is less assembly work and the pipe is easily handled in lengths up to 40 feet. You'll also find Armco "Spiral Welded" strong and durable; smooth inside for peak flow capacity. In tight quarters Armco Pipe gives you a more compact installation.

You can design for utmost economy and still meet your exact requirements with Armco Spiral Welded Pipe. Diameters run from 6 to 36 inches; wall thicknesses from 7/64 to ½-inch. Base metals, coatings and lengths are optional to fit your needs. Let us help you get the most out of that next pipe investment. When you're ready, just mail your drawings and specifications. Meanwhile, ask us to send you our 42-page book full of practical information. The American Rolling Mill Company, 781 Curtis Street, Middletown, Ohio.

ARMCO

ARMCO SPIRAL WELDED PIPE

*According to Safety Standards in many States.

DAYTONS are equipped with safety shoes at no extra cost

Now, because of these safety regulations, the Dayton Safety Ladder is the only ladder sold that conforms with safety standards in every state. For now the Dayton is equipped with the new Queen Safety Shoe at *no added cost*. This remarkable new shoe is of the steel ferrule type, with easily replaceable vacuum cup rubber treads. It absolutely prohibits slipping and sliding.

For double protection, use the Dayton, the original safety ladder.

Write Dept. FMM-10 for details and catalog

The DAYTON Safety Ladder Co.

121-123 W. Third St., CINCINNATI, O.

This is the time for action!

EARNING POWER ASSURED

A man's earning power—no matter his status—in your plant is important to you because through him you produce dollars. Don't impair his capacity for doing fast, economical and profitable work. Provide him with the *very best* safety equipment — because it's a means for you to earn more yourself. This new catalog shows the way.

Write for FREE CATALOG

CHICAGO EYE SHIELD COMPANY

2331 Warren Blvd. Chicago, Ill.

Please send by return mail your new catalog.

Name .....

Company .....

Address .....

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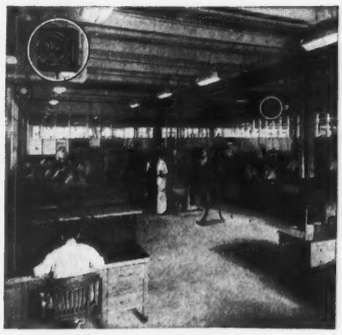
"HEATING IS NO WORRY TO ME ... WITH THE NEW MODINE UNIT HEATER"



YOU CAN'T CHANGE THE SEASONS — WINTER IS ON THE WAY!

But you can *do something about it.* End your heating troubles with the NEW *Modine*—the unit heater that is changing heating history.

The first "new model" Modine in six years—it offers not only a record high in value but the greatest unit heater advancement in a decade. Many of these new and exceptional features will be standard on all good unit heaters eventually—*but only Modine has them now!*

Compare Modine . . . feature by feature . . . with the others. Safety is *built-in* with the New Modine Fan Guard—an extra protection for factory workers. *Bonderizing* protects casing and sheet metal parts against rust under corrosive conditions; insures durability and fine appearance of finish. Sound-silencing insures quiet operation in laboratories and offices.

Then you'll buy Modine—for better all-around heating—more accurate control—greater fuel economy with lower installation, operation and maintenance costs—and the greater dependability proved by Modine's more than a billion hours of satisfactory service. *Get New Modine Catalog 139*—it's free.

NEW **ACOUSTICALLY-TREATED SOUND-SILENCED CASING** — A sound-silencing coating of acoustical mastic covers the entire interior surface of the casing. All noise from within is effectively deadened. **VENTURI FAN SHROUD**, built integral with casing body, eliminates eddy currents; quiets air in-rush sounds.

Only the New Modine Has These Quieter-Operation Features.

NEW **SAFETY FAN GUARD AN INTEGRAL PART OF DESIGN** — Safety Fan Guard is actually incorporated into the basic structure of the Modine unit, securely attached at four points. Instead of the menace of a unit heater fan left unshielded, Modine's staunch steel safeguard gives constant protection. Safety is standard equipment.

Only the New Modine Has Built-In Safety Fan Guard!

NEW **PROTECTION AGAINST RUST — BY BONDERIZING** — Modine is the *first* and the *only* unit heater available *protected against rust by Bonderizing*—Bonderizing not only makes Modine casing and other sheet metal parts resistant to formation and progress of rust. *It holds the finish to the metal,* making it infinitely more durable and permanently fine in appearance.

Only the New Modine is Rust-Protected by Bonderizing.

NEW **BEAUTY OF APPEARANCE REFLECTS MODERN DESIGN**—The cleaner, more flowing lines...rounded corners of the casing...deeply recessed, V-formed louvres...all give the new Modine Unit Heater a virile, modern beauty decidedly in keeping with the latest types of store, office, or industrial plant interiors.

Only the New Modine Gives You Style Leadership.

MODINE
THIS PRODUCT IS
Rust-Protected
by
MODINE
RUST PROTECTION IS PROVIDED BY BONDERIZING
BONDERIZING HOLDS PAINT TO STEEL
NEW
• Safety Fan Guard
• Rust Protection by Bonderizing
• Sound-Silencing
ACOUSTICAL INSULATION DEADENS SOUND
VENTURI FAN SHROUD QUIETS AIR INRUSH
CONCENTRIC RINGS OF FAN GUARD ACT AS VIBRATION DISSIPATORS
MOTOR RESILIENTLY MOUNTED AT 4 POINTS
VELOCITY GENERATOR SPREADS AIR EVENLY—AVOIDS AIR RUSH NOISE PEAKS

MODINE MANUFACTURING COMPANY, 1730 Racine St., RACINE, WIS.

HEATING, COOLING AND AIR CONDITIONING EQUIPMENT

Sold through Heating Contractors and Recognized Wholesalers

THE DIESEL CRANE IS OUT IN FRONT

INDUSTRIAL BROWNHOIST

GENERAL OFFICES: BAY CITY, MICHIGAN

DISTRICT OFFICES

New York, Philadelphia, Pittsburgh, Cleveland, Chicago,

All over America today, Industrial Brownhoist Diesel cranes are replacing steam machines. The reasons why this is so should be of interest to everyone who handles materials.

With good grades of fuel oil available at low cost in most localities, the Industrial Brownhoist Diesel can effect a saving of at least 25% over existing handling costs. Furthermore, the Diesel crane is easier to operate and its two-speed travel and sustained power are a revelation to anyone whose work includes car switching. Last, but not least, the Industrial Brownhoist Diesel will have done an hour's work or more each morning while the steam crane is taking on coal and water and getting "steamed up".

Would it surprise you if an Industrial Brownhoist Diesel could pay for itself in two to three years on your work? We are confident that it would. May we help you compile the comparative figures?

LOUDER —TALK LOUDER!

This acoustical booth betters phone service

● Shop telephone mistakes are often serious. Improve your shop telephone service and stop these wasteful errors. Do what hundreds of plant managers have done—install a Burgess Acousti-Booth.

Complete Information Sent

Learn why this acoustically engineered booth improves telephone hearing conditions. Find out why it blots up noise and makes telephoning easy. Send the coupon for the Free Booklet giving illustrations of all models, prices, specifications, list of users. SEND IT NOW!

Send this coupon for Free Acousti-Booth Booklet

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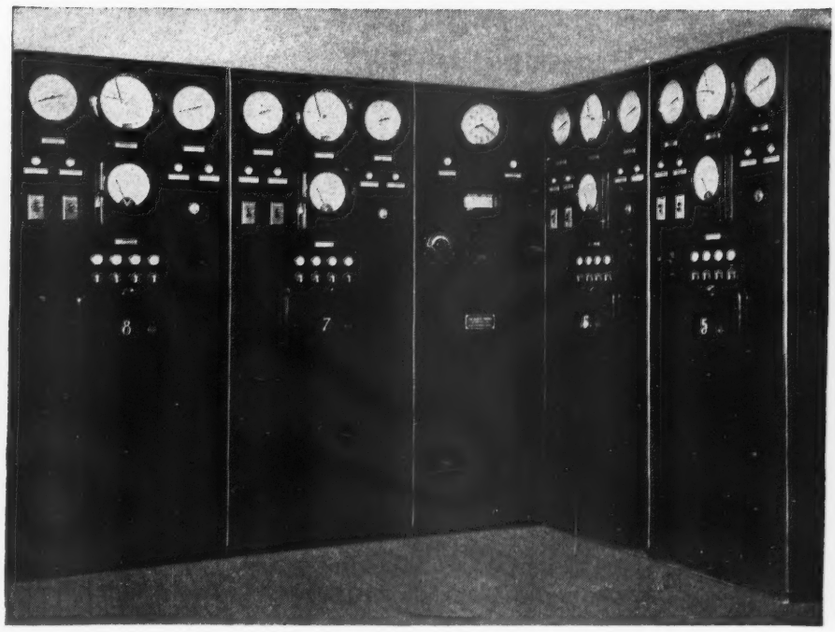

In many plants today, there still lurks the menace of production "blind spots." An intricate or concealed operation here, a critical cycle there—that up to now has eluded your efforts to control it within modern manufacturing tolerances.

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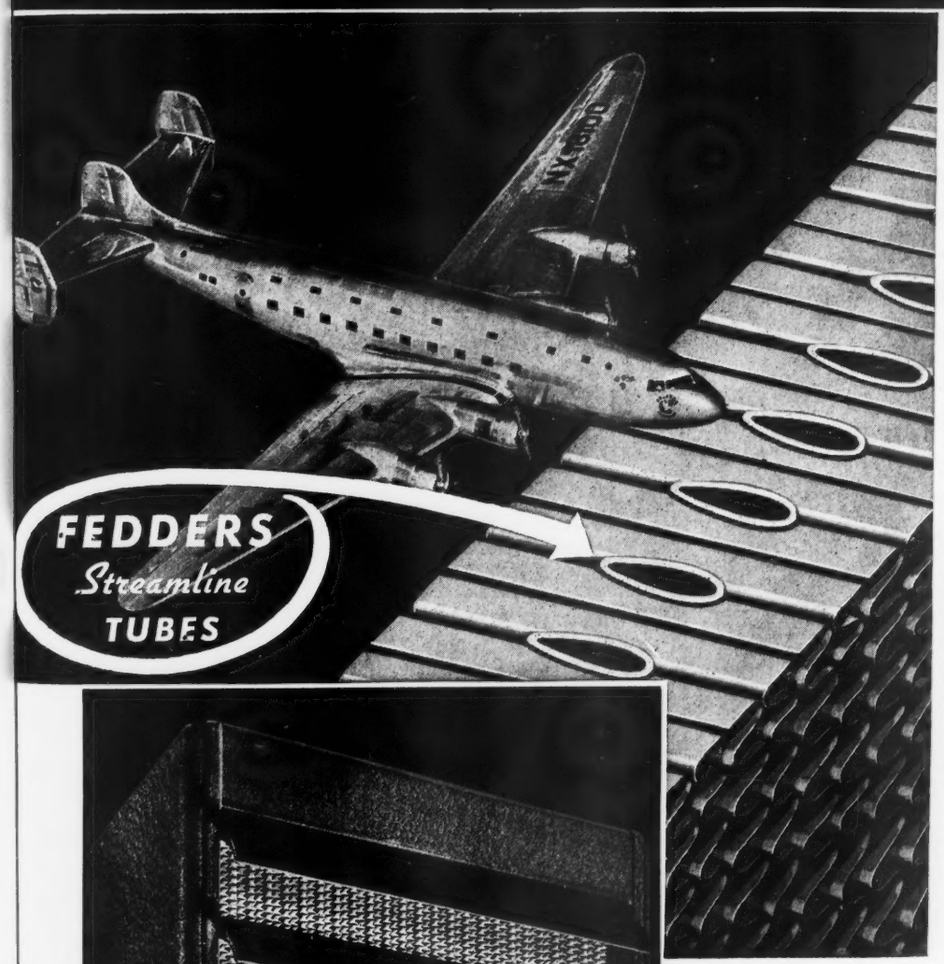

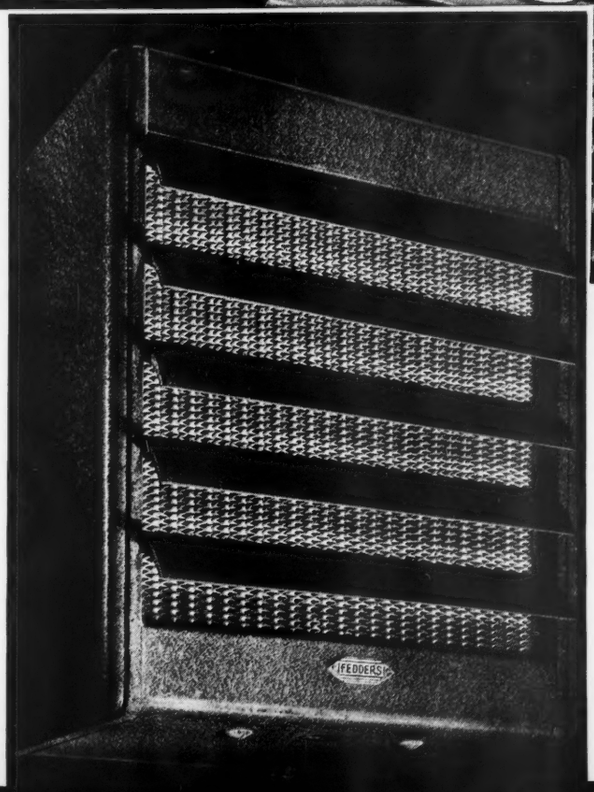

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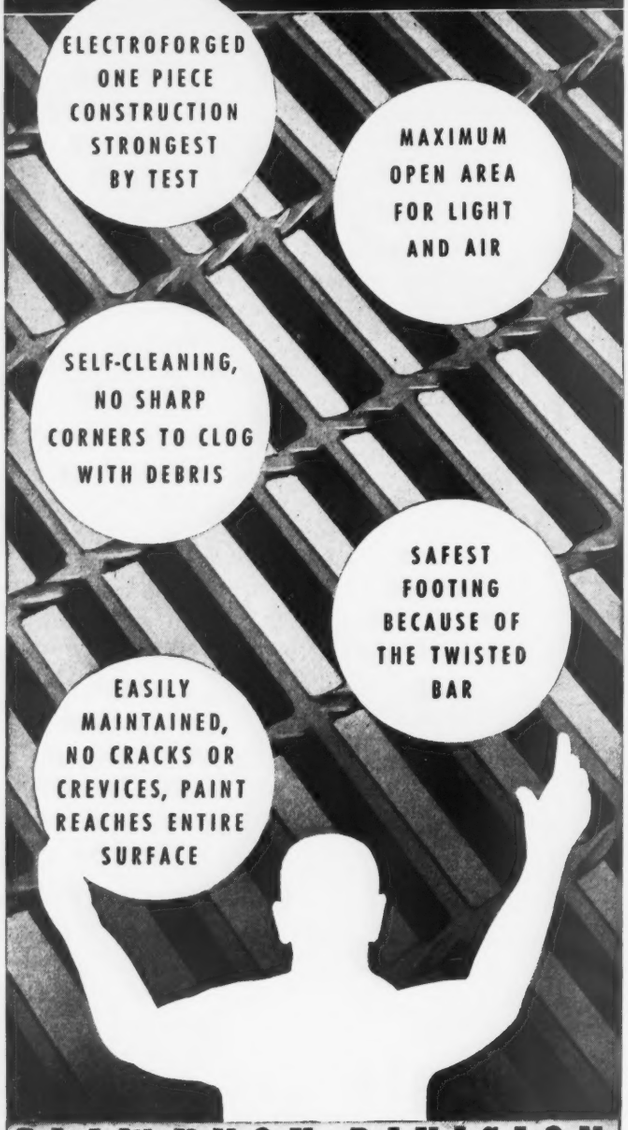
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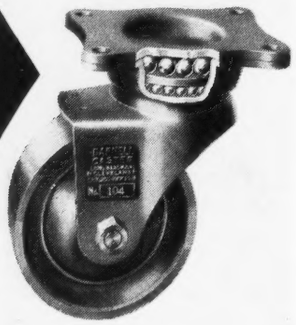

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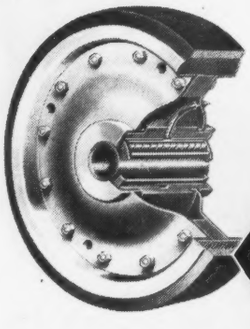

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That, too, means little. How long will the paint protect?

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How long the paint will protect—that's the vital point.

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"Guess so, Jim, this place is full of it— and I am, too."

(Photo Courtesy of Pangborn)

WHEN dust or fumes menace the health of employees, this hazard must be dealt with quickly and positively. And the remedy must be as certain as long experience can make it.

That's why it pays to call in Sturtevant when you have a dust or fume removal problem—and take advantage of Sturtevant's 75 years of air engineering experience.

Sturtevant Dust and Fume Removal Systems are expertly designed to meet each individual need. They provide not only effective removal of dust and fumes—but also assure the advantages of low power consumption and space economy.

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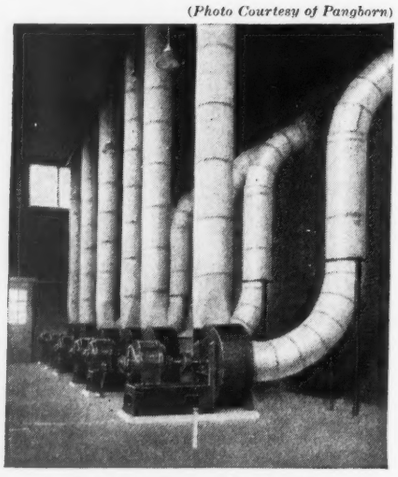

Dust collecting system used for blasting equipment. Six Sturtevant Exhausters shown.

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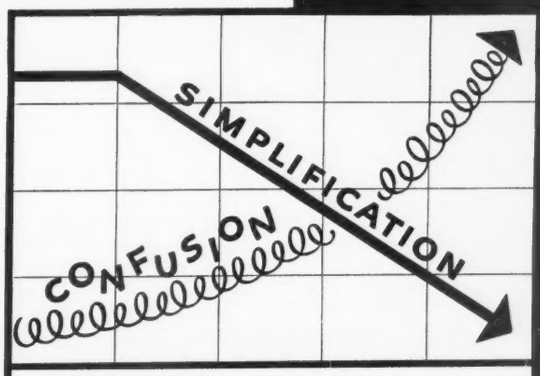

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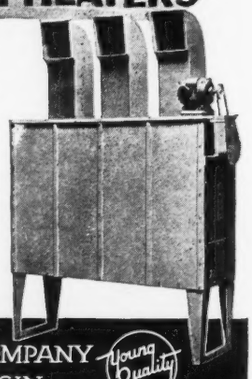

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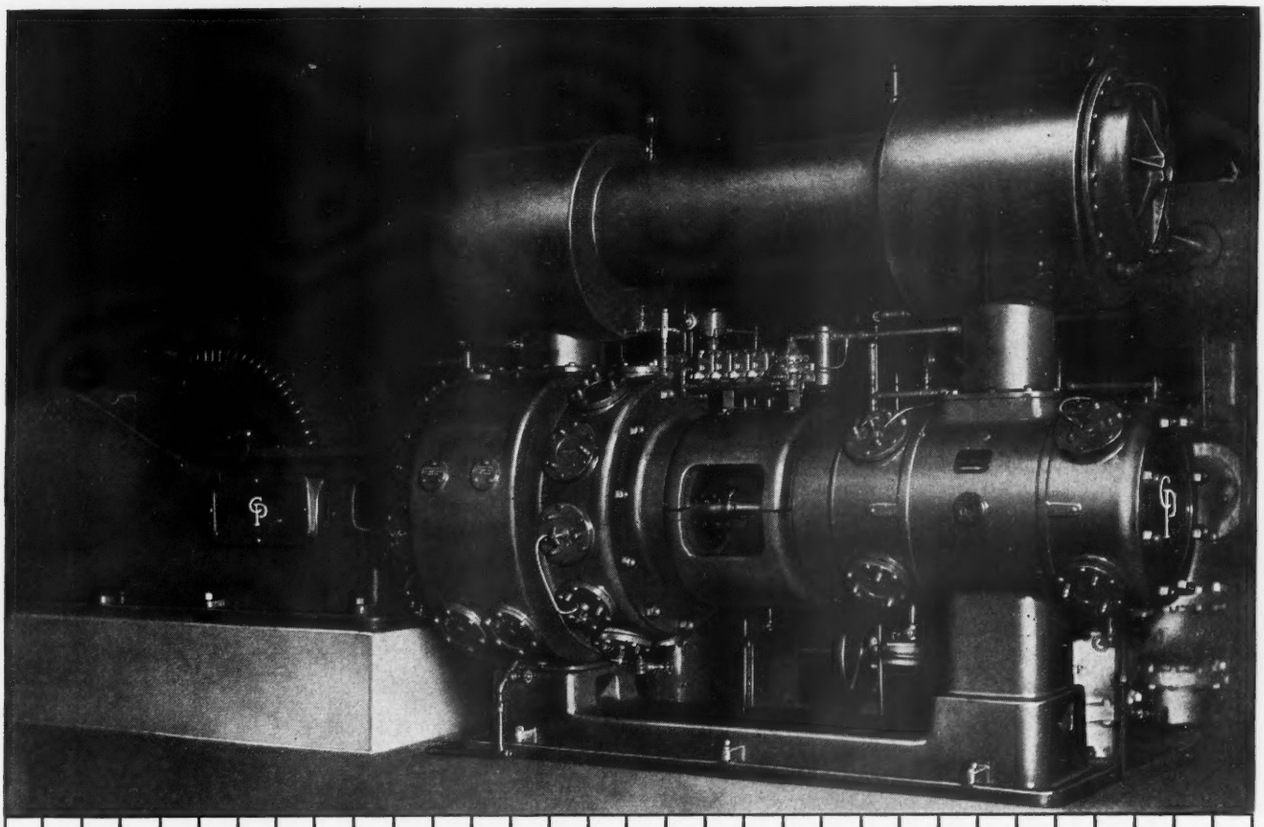

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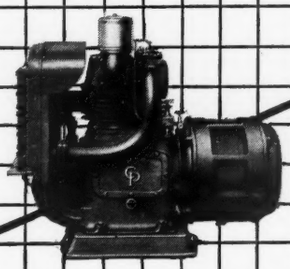

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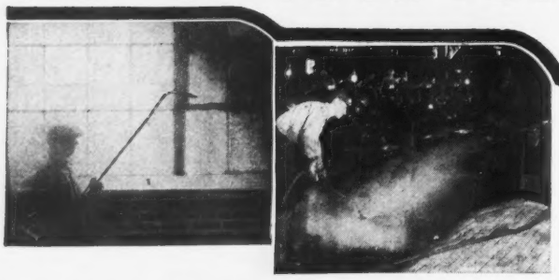

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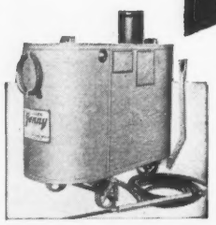

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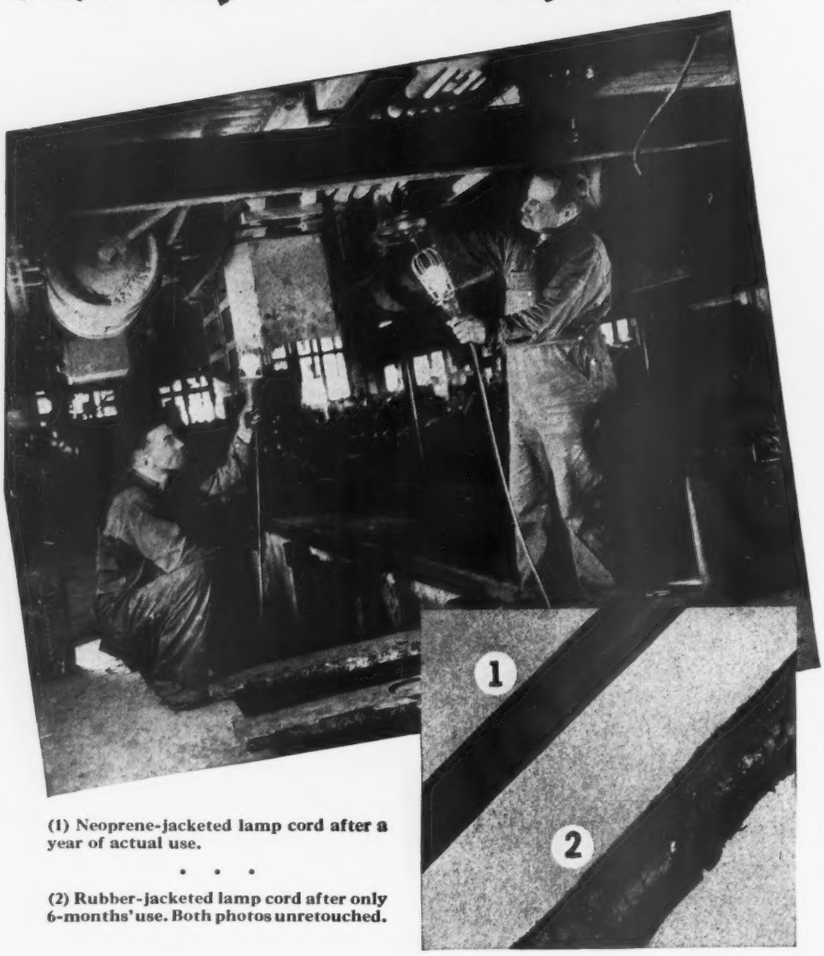

(1) Neoprene-jacketed lamp cord after a year of actual use.

• • •

(2) Rubber-jacketed lamp cord after only 6-months' use. Both photos unretouched.

See how shop test proves economy of neoprene lamp cable

IF YOU'RE in the market for better portable cable at lower maintenance cost (and who isn't?), you can profit by this experience of a city street railway company . . .

The superintendent of this street railway, intent on cutting upkeep costs, decided among other things that lamp cord in the shops needed replacing too often. Oil and grease were rotting the cotton covering.

Experimenting with other covering materials, he found that high-grade rubber jacketing was an improvement over the cotton. But when this rubber jacketing was, in turn, tested against jacketing of Du Pont *neoprene* . . . neoprene won in a walk. Because while neoprene, Du Pont's remarkable chloroprene rubber, has the strength, elasticity and toughness of natural rubber . . . it is far less affected by oils, gasoline, sunlight, ozone and air.

Neoprene covered cord is now standard in this street railway shop. Repair and replacement costs have gone down. And the superintendent's stock, you may be sure, has gone up.

Take the hint. Specify neoprene covering next time you buy portable cable. Look for neoprene parts in other equipment you buy. That's your assurance of top quality, long service, and lowest maintenance cost.

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RUBBER CHEMICALS DIVISION, WILMINGTON, DELAWARE

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For additional information write Departmental Advertising Staff

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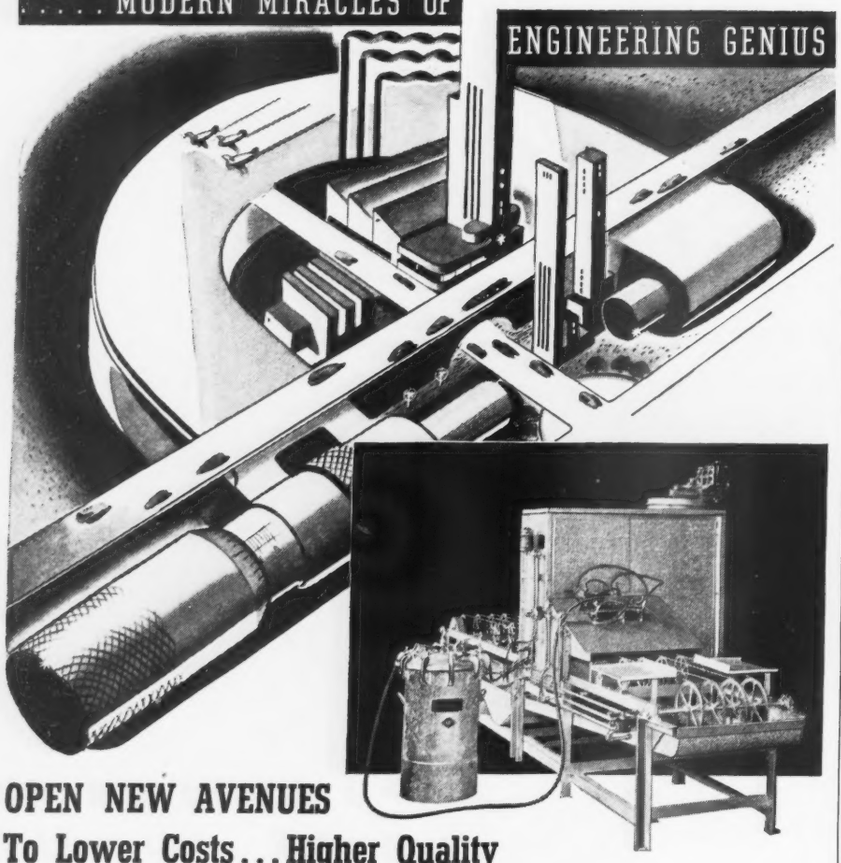

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GRADUATE ENGINEER desires position as assistant to Plant Manager or Superintendent in New England, preferably Connecticut. Age 25; B.S. 1937. Experienced in purchasing, layout, construction, maintenance, supervision and some production methods. At present, employed in large western N.Y. industrial company. PW-597, Factory Management and Maintenance, 330 W. 42nd St., New York, N.Y.

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Dealing with principles only, we will either work on a royalty basis, or purchase outright the article after our rigid investigation of its possibilities. We prefer to manufacture in or near Indianapolis and at first on a modest basis capable of proper expansion.

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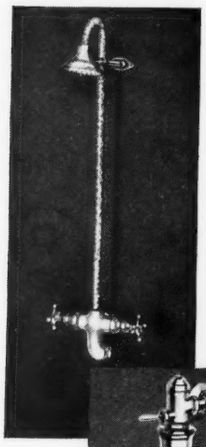

Your factory shower room can be equipped at low cost with Crane No. C 4680-FN galvanized fixtures. Sturdily built, with rough brass valves and shower head.

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A favorite in steel and textile mills, this No. C 11958 King Cotton washdown closet withstands hard use and abuse. Its extra heavy vitreous china bowl and hard rubber seat are easily cleaned.

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WHEN the quitting bell rings and there's a rush for the washroom, what are conditions in your plant? Congestion — delays — bad tempers — grumbling? — or smiling satisfaction because washroom facilities are really adequate and convenient?

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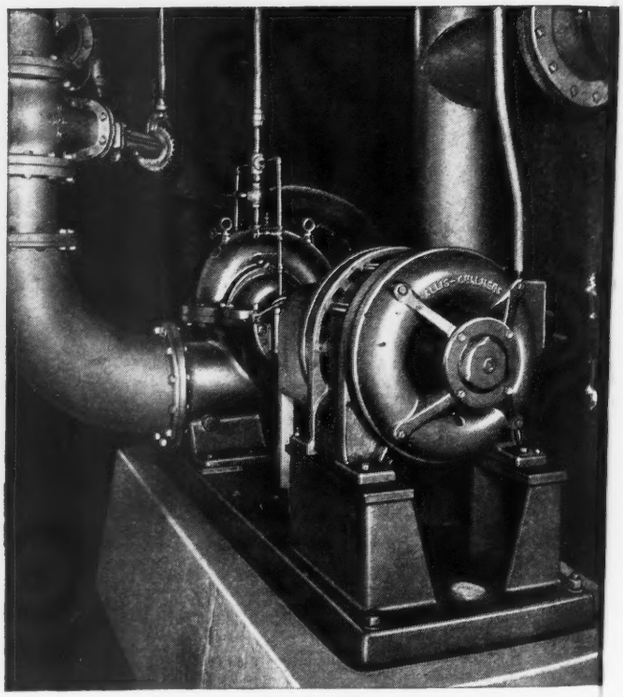
Northwest Paper Company Replaces Old Pump with New Allis-Chalmers Pump . . . Saves $6.48 Per Day . . . Pays for Itself in Eight Months! Read Why It Pays To Modernize Your Pumping Equipment!



INSTALLATION OF THIS ALLIS-Chalmers Centrifugal Pump with 25 hp Lo-Maintenance Motor, is bringing a savings of $6.48 a day to the Northwest Paper Company! Read this interesting story of increased production and economy!

Here's a sensational economy story that hits home to every plant executive who wants to get increased pumpage capacity . . . at less cost!

At the Northwest Paper Company plant in Brainerd, Minnesota, they were using an old belt-driven fan pump to handle one-half of one per cent stock. By actual test they found the old pump required 71 brake horsepower . . . a figure they realized was too high by modern standards.

And because they wanted to make the most savings possible . . . and be "set" for years to come . . . they put in an Allis-Chalmers Centrifugal Pump, connected to a 25 hp Lo-Maintenance Motor.

But the best news was yet to come. For when they made their tests on the new pump, here's what they found . . .

The new Allis-Chalmers Pump actually threw more stock and yet the test showed it required only 23 brake horsepower! Compared to 71 brake horsepower of the former pump, this means a saving of 48 brake horsepower...an actual dollars and cents saving of $6.48 per day!

Saves $1700 Per Year!

Measured in terms of long-time economy, the new pump paid for itself in eight months . . . and went right on piling up savings after that of better than $1,700 a year...a clear-cut profit!

These are savings figures you can't afford to ignore! If you have old pumping equipment in your plant . . . if you want to find out how to replace that equipment with new pumps that pay their own way . . . you'll want to know about the Allis-Chalmers line of modern centrifugal pumps!

Get the facts about these low cost, compact, high efficiency pumps . . . call the district office near you . . . or write direct to Allis-Chalmers. That's how you can cut your pumping costs . . . add to your profits!

A-1113

. . . 90 Years of Engineering Superiority Work for You When You Specify Allis-Chalmers!

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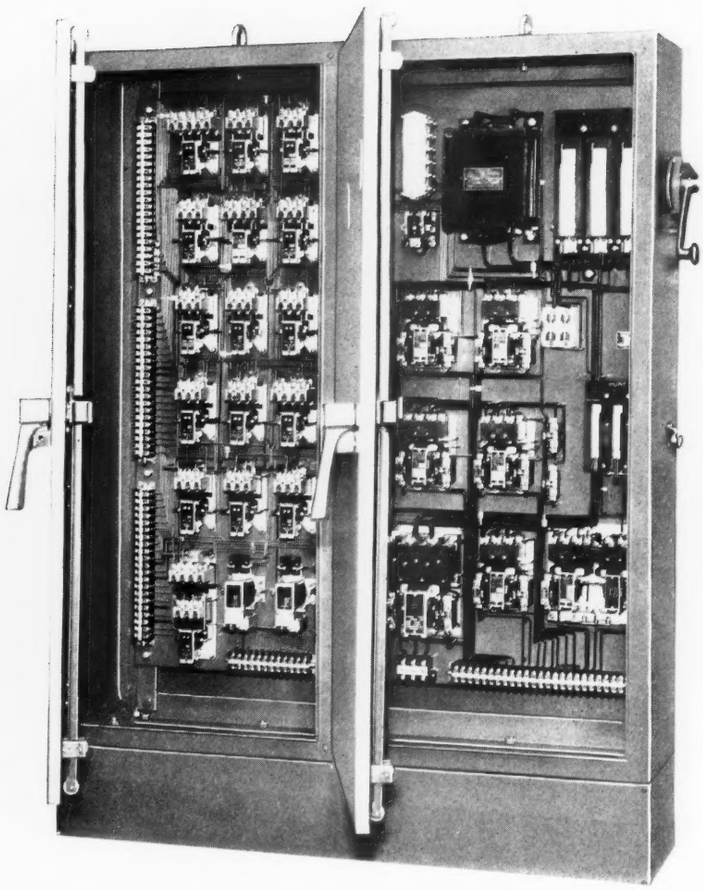

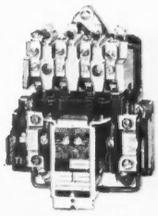

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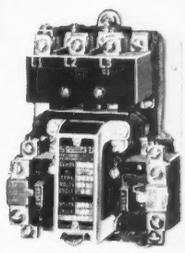
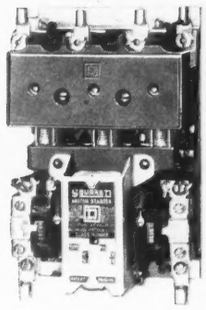


SIZE 1 STARTER



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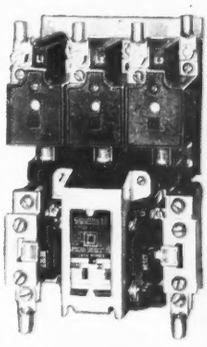
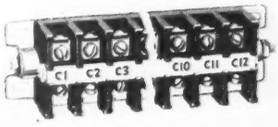


SIZE 3 STARTER



TERMINAL BLOCK

TIMING RELAY

● All types and sizes of standard Square D automatic motor control are designed for panel board mounting; automatic starters, magnetic contactors, timing mechanisms, interlocking relays, switches, circuit breakers and overload protective devices. These are stock items and can be assembled in any form of machine tool panel board—quickly and economically.

Square D control panels have the same features of accessibility and low maintenance cost characteristic of its starters and controllers.

High quality apparatus, plus engineering service founded on years of experience in designing automatic control panels, make Square D the logical choice for machine tool control. Specify Square D. Machine tool builders will gladly supply it.

CALL IN A SQUARE D MAN

SQUARE D COMPANY

DETROIT - MILWAUKEE - LOS ANGELES

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

MORSE Roller CHAIN

INTERCHANGEABLE

The Morse 3700 Series Roller Chain is interchangeable with every other standard round pin roller chain. A new and effective design makes possible complete interchangeability without sacrificing the lubricating features which make Morse Roller Chains so outstanding in the power drive field.

Morse Roller Chain on new equipment or for replacement will bring to roller chain power drives longer life, quieter operation, greater ruggedness, plus the flexibility of a conventional type chain. . . And remember, Morse Roller Chains cost no more than ordinary type drives!

ALL PARTS INTERCHANGEABLE WITH ALL STANDARD ROLLER CHAINS

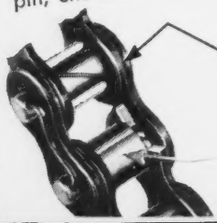
for chains with uneven number of links

RETAINS ITS LUBRICATING FEATURES

The patented design of the Morse round-pin chain builds an oil feed system in every link!

Oil placed on the rollers flows to the bushing surface, where spaced channels extend the full width of the bushing face, through bushing side plates. Oil follows along channels to the pin sideplates and to the pin, spreads over the entire pin and bushing contact surfaces.

The Morse man in your territory or Morse, Ithaca, will tell you all about the Morse round-pin, channel lubricated Roller Chain.



Instead of oiling the chain between side plates to reach wearing surfaces (as in conventional roller chains)—

Morse provides a path for oil from rollers, out through side plates to pin surfaces—where wear takes place.

SILENT CHAINS ROLLER CHAINS FLEXIBLE COUPLINGS KELPO CLUTCHES

MORSE *positive* DRIVES

MORSE CHAIN COMPANY ITHACA N. Y. DIVISION BORG-WARNER CORP.